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Sinha et al.

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(54) **METHOD AND SYSTEM FOR OUTCOME PREDICTION UTILIZING AUTOMATIC CONTENT RECOGNITION**

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This patent is subject to a terminal disclaimer.

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(51) **Int. Cl.**
H04N 7/173 (2011.01)
H04N 7/16 (2011.01)

(Continued)

(52) **U.S. Cl.**
CPC ***H04N 21/44008*** (2013.01); ***G06T 1/0021*** (2013.01); ***G06F 17/30495*** (2013.01); ***G06F 3/0484*** (2013.01); ***H04N 21/442*** (2013.01);

(Continued)

(58) **Field of Classification Search**
CPC H04N 21/812; H04N 7/17318
USPC 725/23, 60, 141, 153, 133
See application file for complete search history.

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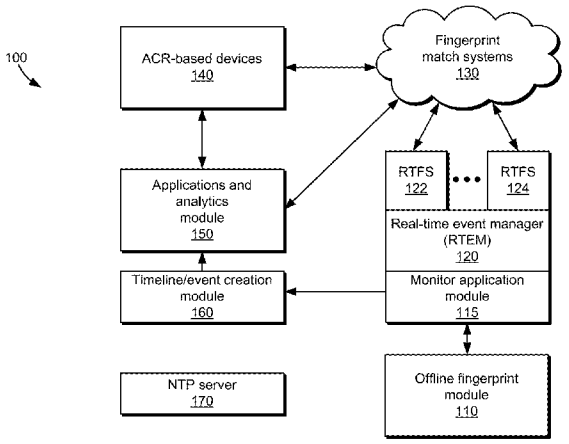
(57) **ABSTRACT**

An automatic content recognition (ACR)-enabled connected TV device may be operable to identify, utilizing an ACR system, an event that is to take place in a presented program. An overlay, which comprises information on possible outcomes of the identified event, may be presented by the ACR-enabled connected device utilizing the ACR system, within a specific time window synchronized with the identified event. The ACR-enabled connected device may identify, utilizing the ACR system, a predicted outcome selected by a viewer. The predicted outcome may be selected, within the specific time window, via interaction with the overlay on the ACR-enabled connected device. An actual outcome that actually takes place may be identified by the ACR-enabled connected device utilizing the ACR system. The ACR-enabled connected device may present, utilizing the ACR system, a message indicating whether the viewer is correct based on the identified actual outcome.

21 Claims, 13 Drawing Sheets



(51) **Int. Cl.**

H04N 5/445	(2011.01)
H04N 21/44	(2011.01)
G06T 1/00	(2006.01)
G06F 17/30	(2006.01)
G06F 3/0484	(2013.01)
H04N 21/442	(2011.01)
H04N 21/4784	(2011.01)
H04N 21/4722	(2011.01)
H04N 21/478	(2011.01)
H04N 21/441	(2011.01)
H04N 21/81	(2011.01)
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H04N 21/00	(2011.01)

(52) **U.S. Cl.**

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USPC **725/133**; 725/23; 725/60; 725/141; 725/153

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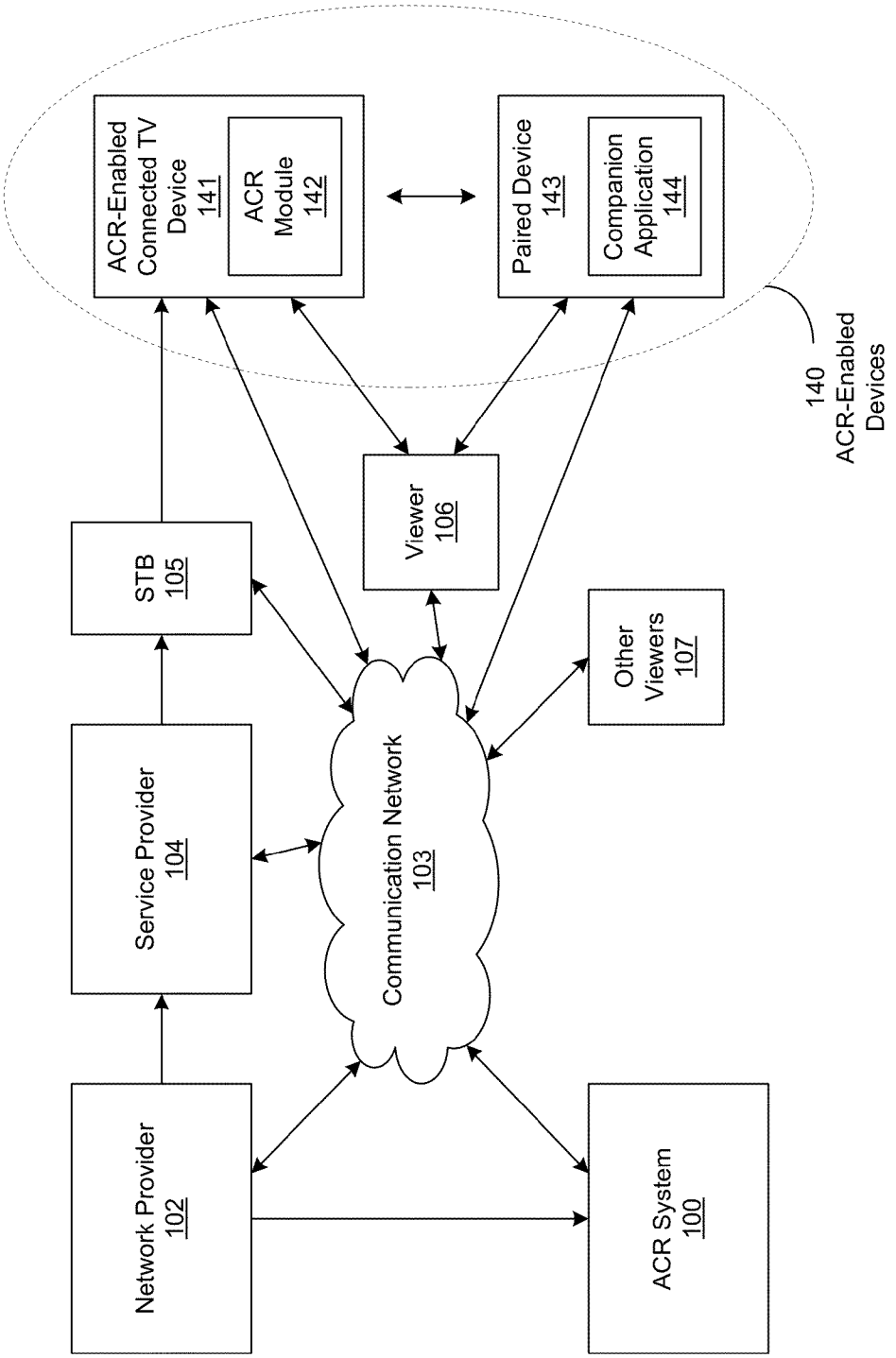
ACR-Enabled Connected TV Device 141
ACR Module 142
Paired Device 143
Companion Application 144
140 ACR-Enabled Devices
STB 105
Viewer 106
Other Viewers 107
Service Provider 104
Communication Network 103
Network Provider 102
ACR System 100

FIG. 1A

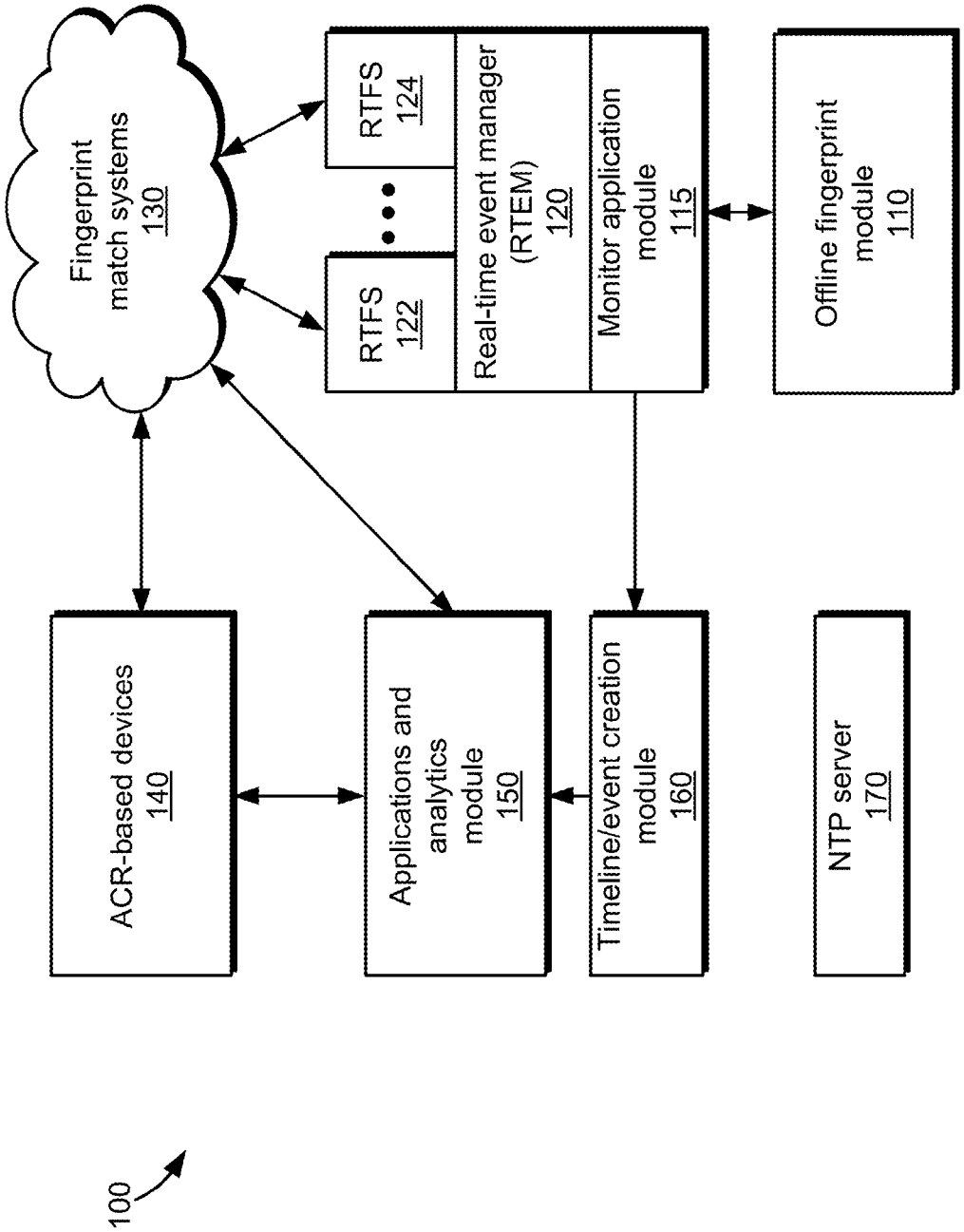
Fingerprint match systems 130
RTFS 122
RTFS 124
Real-time event manager (RTEM) 120
Monitor application module 115
Offline fingerprint module 110
ACR-based devices 140
Applications and analytics module 150
Timeline/event creation module 160
NTP server 170
100

FIG. 1B

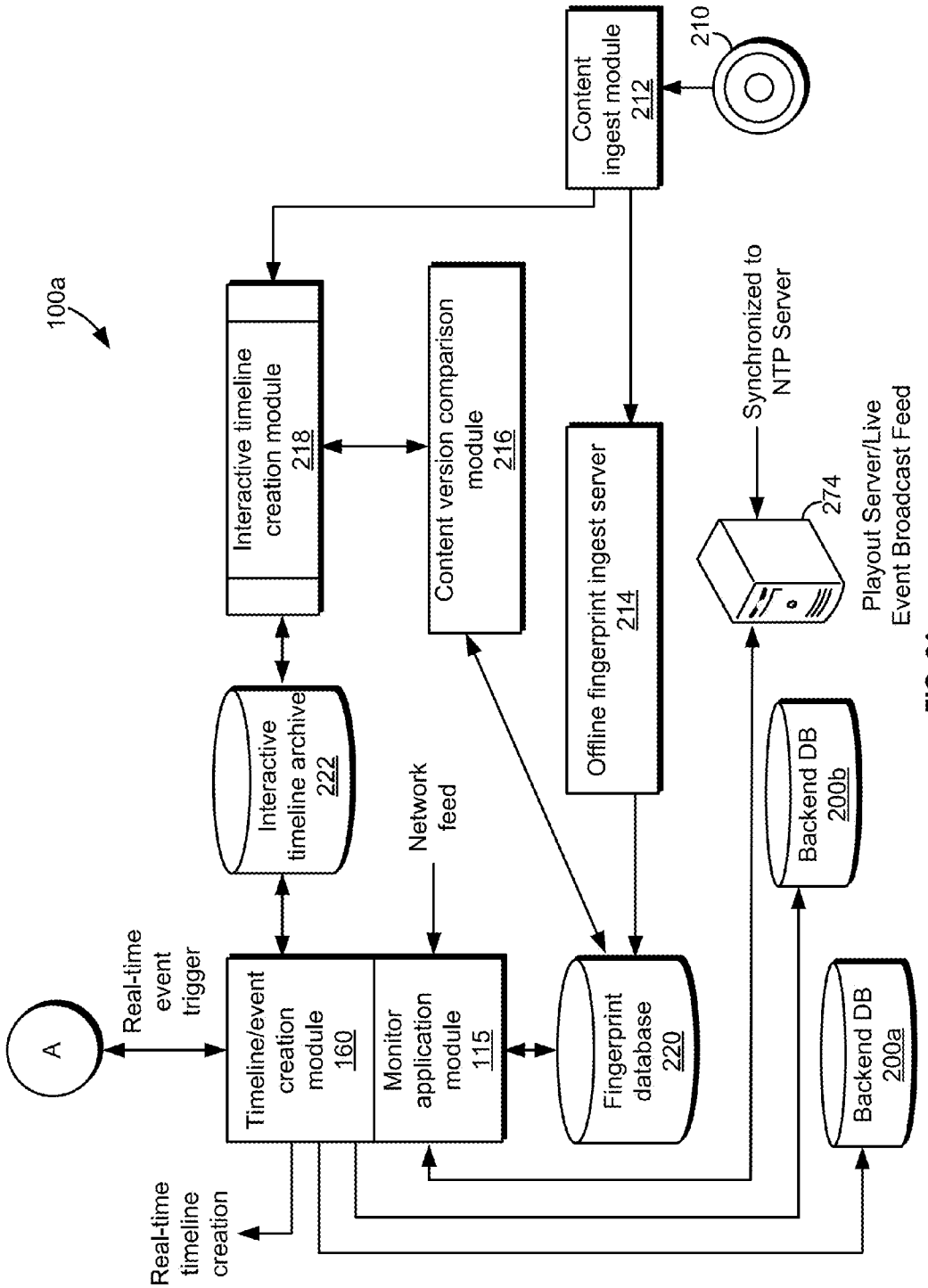
100a
Content ingest module 212
210
Interactive timeline creation module 218
Content version comparison module 216
Offline fingerprint ingest server 214
Synchronized to NTP Server
274
Playout Server/Live Event Broadcast Feed
Interactive timeline archive 222
Network feed
Backend DB 200b
Backend DB 200a
A
Real-time event trigger
Timeline/event creation module 160
Monitor application module 115
Fingerprint database 220
Real-time timeline creation

FIG. 2A

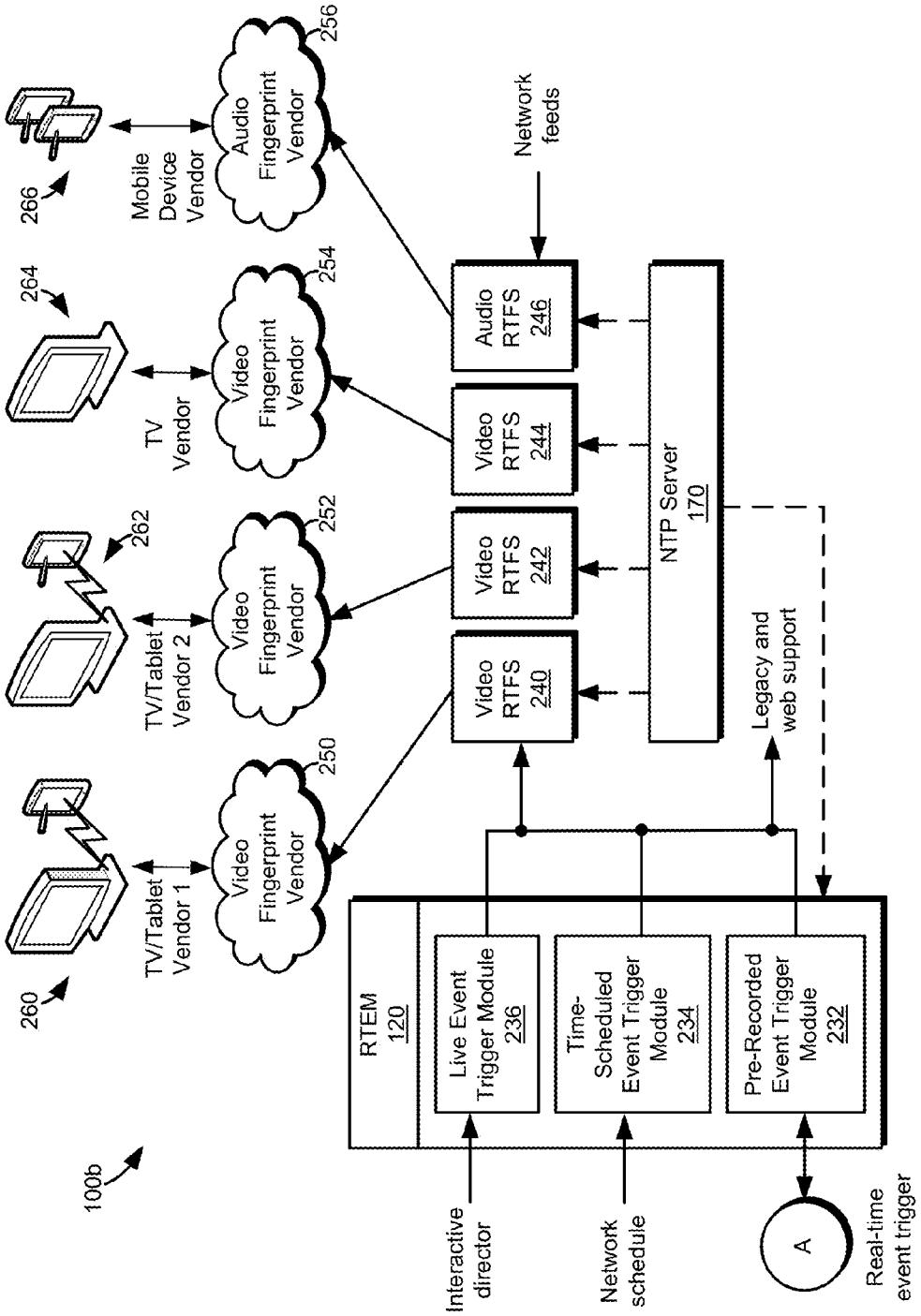
100b
260
TV/Tablet Vendor 1
Video Fingerprint Vendor
250
262
TV/Tablet Vendor 2
Video Fingerprint Vendor
252
264
TV Vendor
Video Fingerprint Vendor
254
266
Mobile Device Vendor
Audio Fingerprint Vendor
256
Network feeds
Video RTFS 240
Video RTFS 242
Video RTFS 244
Audio RTFS 246
NTP Server 170
Legacy and web support
RTEM 120
Live Event Trigger Module 236
Time-Scheduled Event Trigger Module 234
Pre-Recorded Event Trigger Module 232
Interactive director
Network schedule
A
Real-time event trigger

FIG. 2B

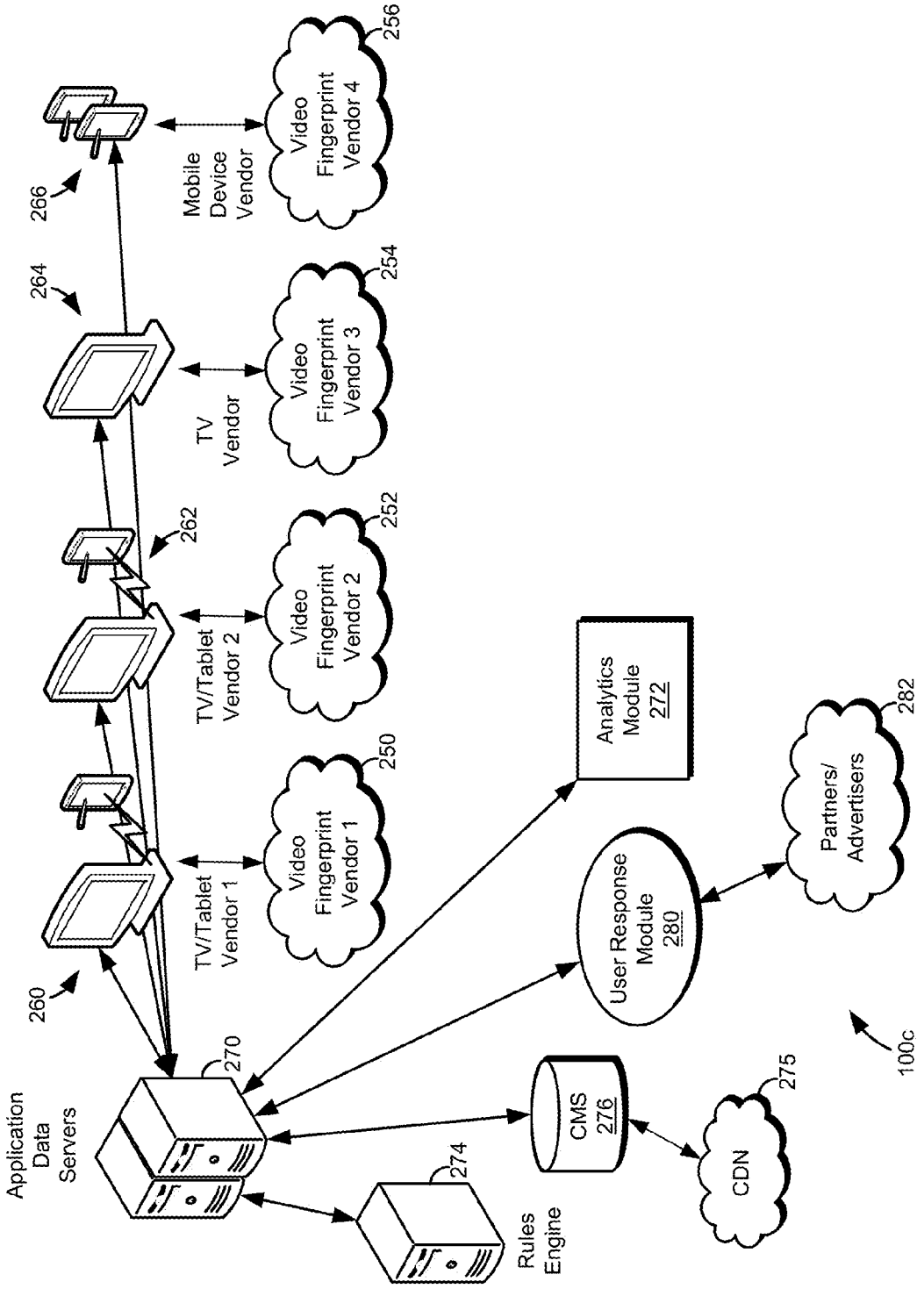
Application Data Servers
270
260
262
264
266
TV/Tablet Vendor 1
TV/Tablet Vendor 2
TV Vendor
Mobile Device Vendor
Video Fingerprint Vendor 1
250
Video Fingerprint Vendor 2
252
Video Fingerprint Vendor 3
254
Video Fingerprint Vendor 4
256
Analytics Module 272
User Response Module 280
Partners/ Advertisers
282
CMS 276
CDN
275
Rules Engine
274
100c

FIG. 2C

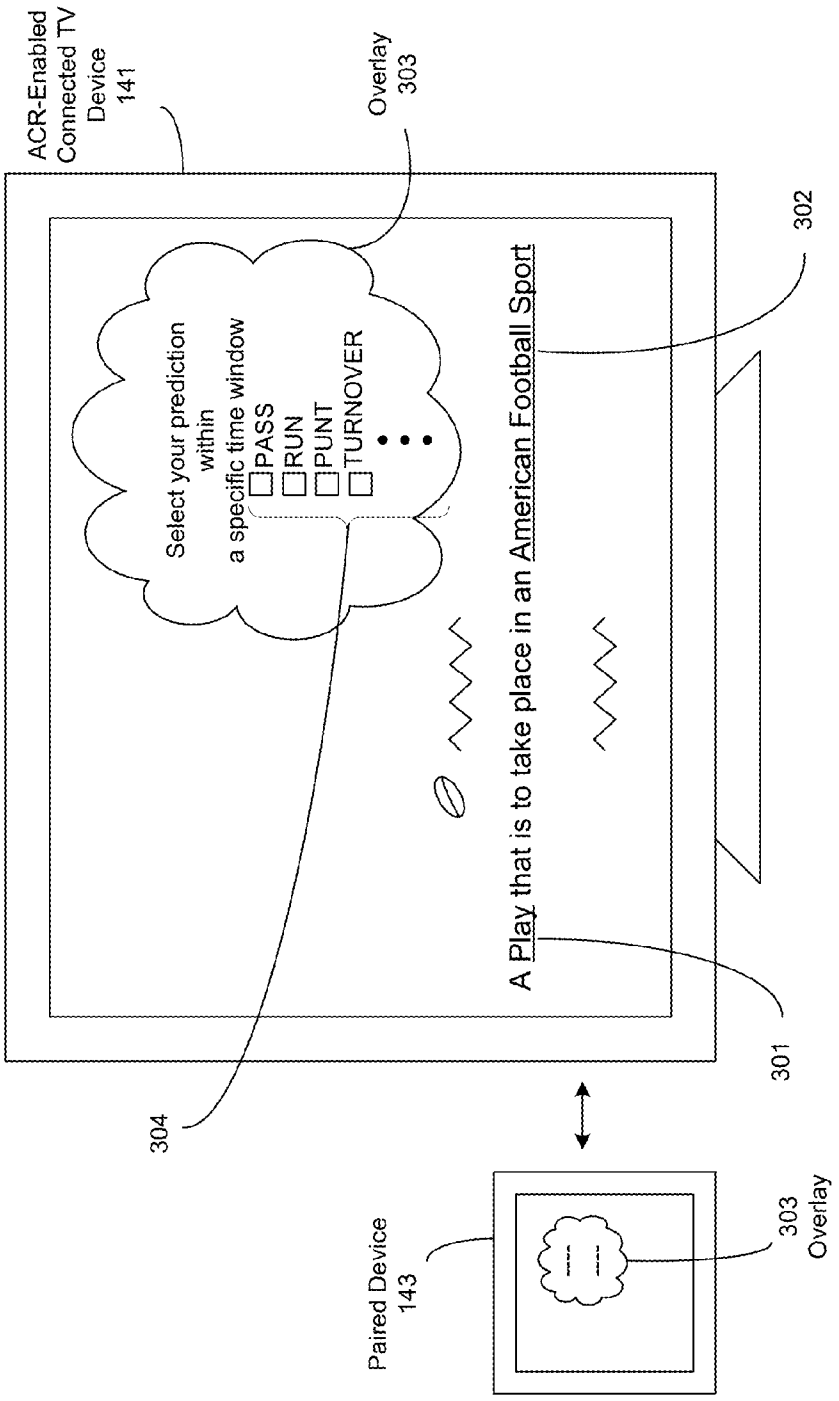
ACR-Enabled Connected TV Device 141
Overlay 303
Select your prediction within a specific time window
PASS
RUN
PUNT
TURNOVER
A Play that is to take place in an American Football Sport
302
301
304
Paired Device 143
303 Overlay

FIG. 3A

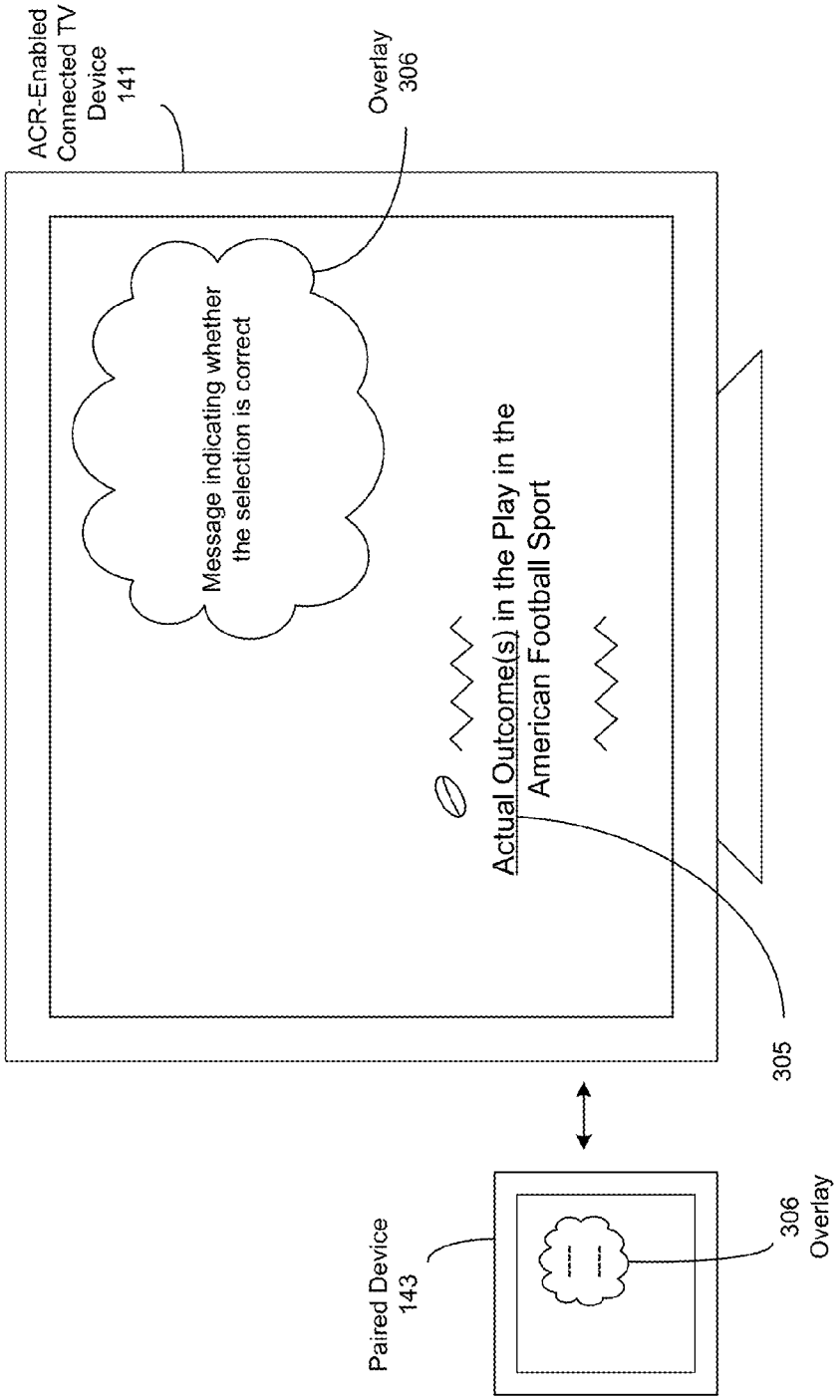
ACR-Enabled Connected TV Device 141
Overlay 306
Message indicating whether the selection is correct
Actual Outcome(s) in the Play in the American Football Sport
305
Paired Device 143
306 Overlay

FIG. 3B

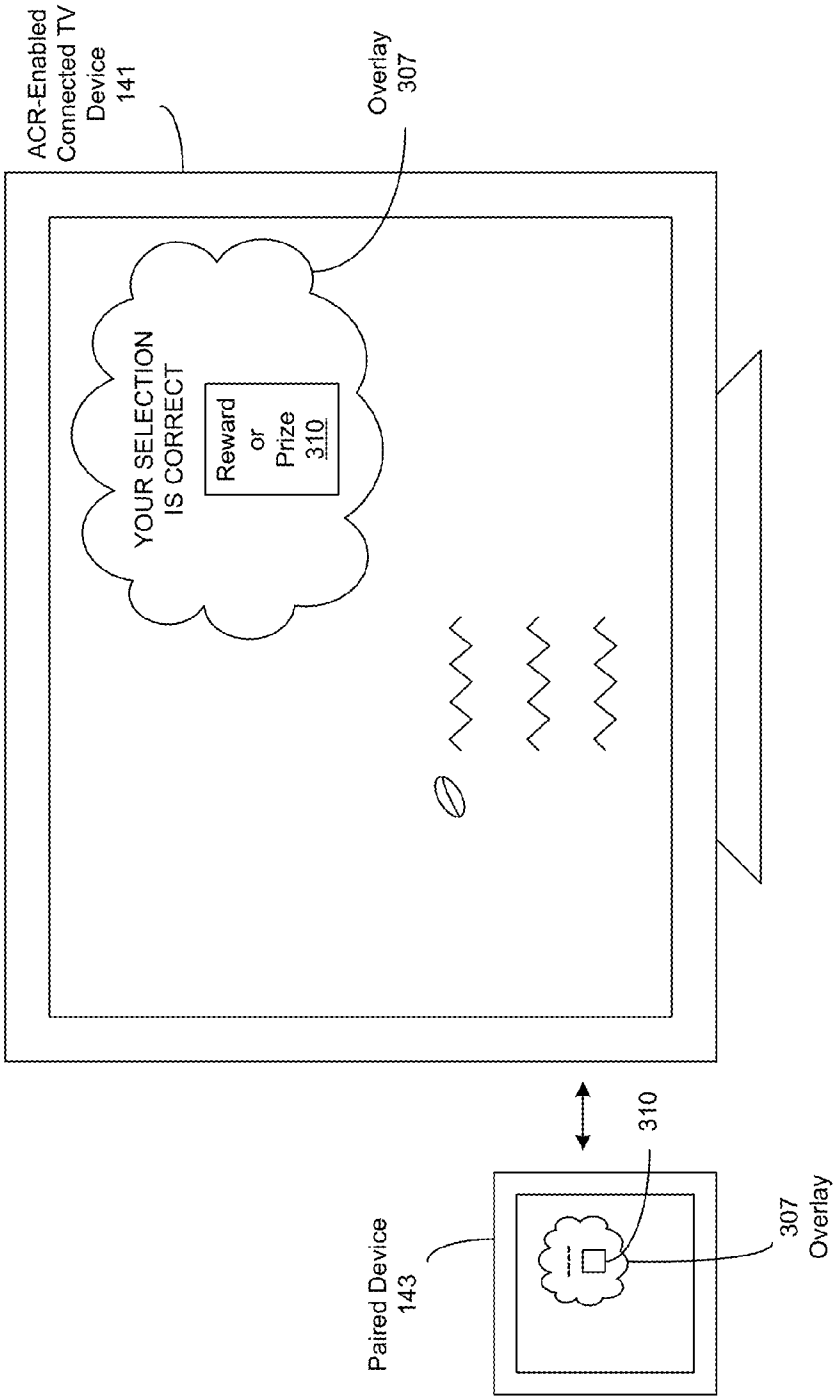
ACR-Enabled Connected TV Device 141
Overlay 307
YOUR SELECTION IS CORRECT
Reward or Prize 310
Paired Device 143
310
307 Overlay

FIG. 3C

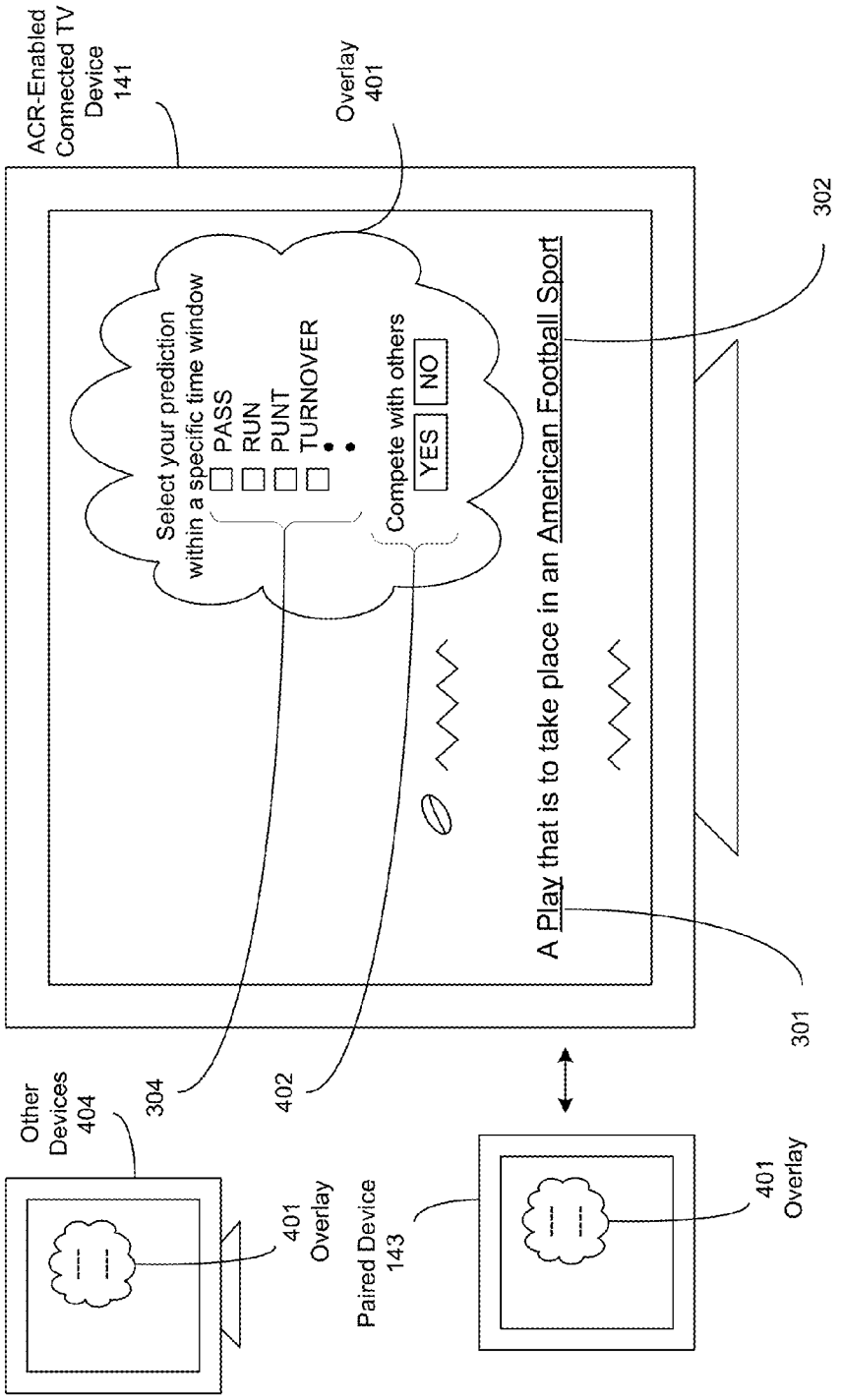
ACR-Enabled Connected TV Device 141
Overlay 401
302
Select your prediction within a specific time window
PASS
RUN
PUNT
TURNOVER
Compete with others
YES
NO
A Play that is to take place in an American Football Sport
301
304
402
Other Devices 404
401 Overlay
Paired Device 143
401 Overlay

FIG. 4A

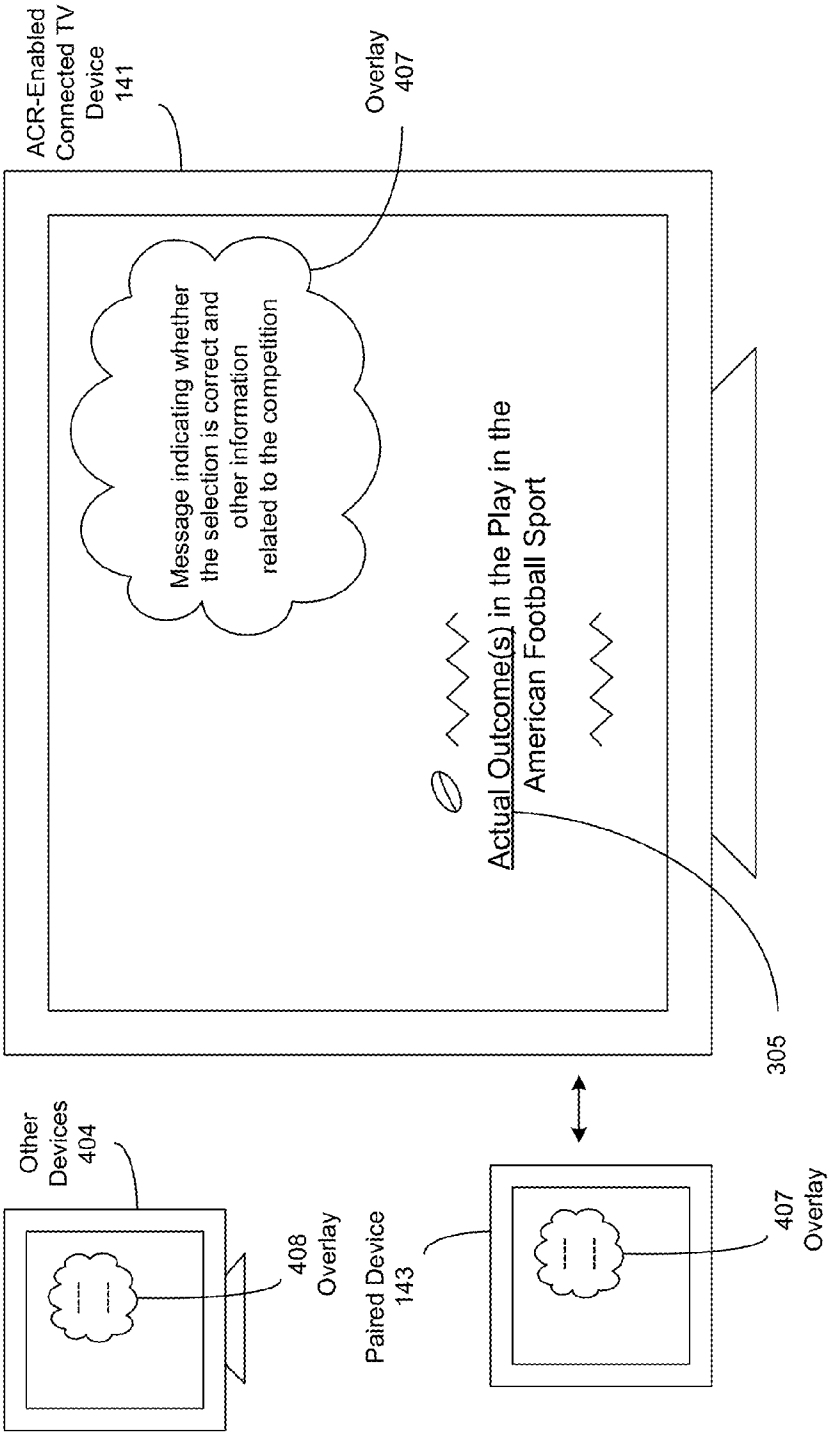
ACR-Enabled Connected TV Device 141
Overlay 407
Message indicating whether the selection is correct and other information related to the competition
Actual Outcome(s) in the Play in the American Football Sport
305
Other Devices 404
408 Overlay
Paired Device 143
407 Overlay

FIG. 4B

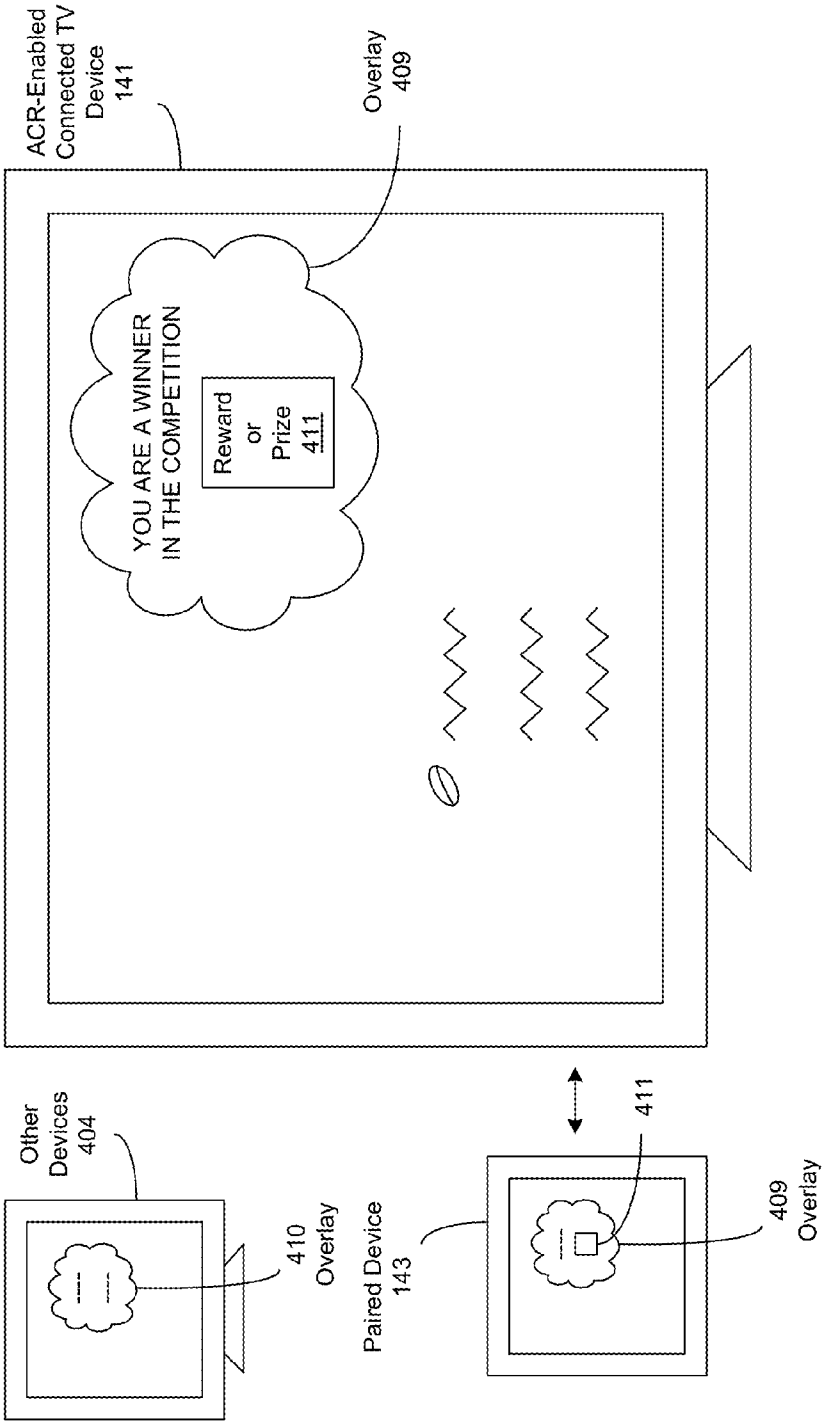
ACR-Enabled Connected TV Device 141
Overlay 409
YOU ARE A WINNER IN THE COMPETITION
Reward or Prize 411
Other Devices 404
410 Overlay
Paired Device 143
411
409 Overlay

FIG. 4C

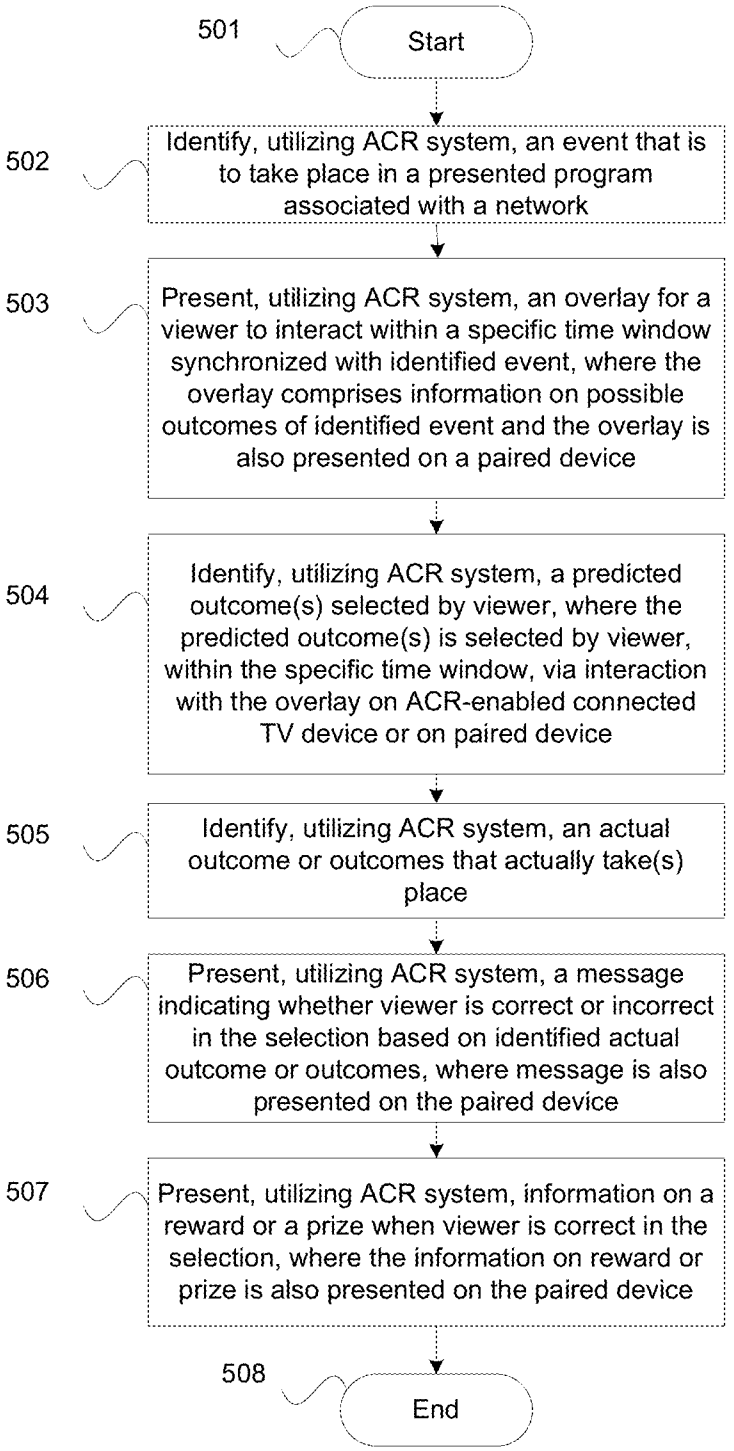
501
Start
502
Identify, utilizing ACR system, an event that is to take place in a presented program associated with a network
503
Present, utilizing ACR system, an overlay for a viewer to interact within a specific time window synchronized with identified event, where the overlay comprises information on possible outcomes of identified event and the overlay is also presented on a paired device
504
Identify, utilizing ACR system, a predicted outcome(s) selected by viewer, where the predicted outcome(s) is selected by viewer, within the specific time window, via interaction with the overlay on ACR-enabled connected TV device or on paired device
505
Identify, utilizing ACR system, an actual outcome or outcomes that actually take(s) place
506
Present, utilizing ACR system, a message indicating whether viewer is correct or incorrect in the selection based on identified actual outcome or outcomes, where message is also presented on the paired device
507
Present, utilizing ACR system, information on a reward or a prize when viewer is correct in the selection, where the information on reward or prize is also presented on the paired device
508
End

FIG. 5

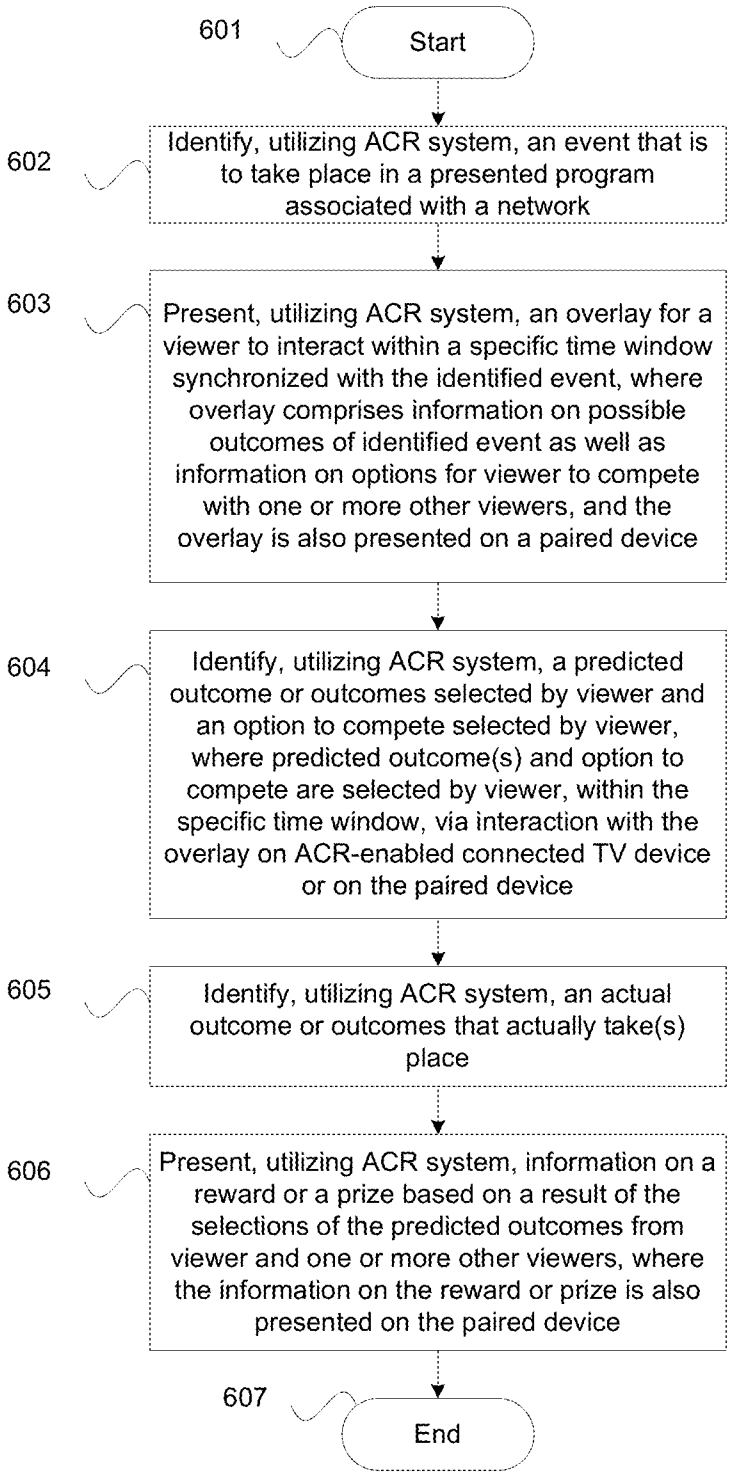
601
Start
602
Identify, utilizing ACR system, an event that is to take place in a presented program associated with a network
603
Present, utilizing ACR system, an overlay for a viewer to interact within a specific time window synchronized with the identified event, where overlay comprises information on possible outcomes of identified event as well as information on options for viewer to compete with one or more other viewers, and the overlay is also presented on a paired device
604
Identify, utilizing ACR system, a predicted outcome or outcomes selected by viewer and an option to compete selected by viewer, where predicted outcome(s) and option to compete are selected by viewer, within the specific time window, via interaction with the overlay on ACR-enabled connected TV device or on the paired device
605
Identify, utilizing ACR system, an actual outcome or outcomes that actually take(s) place
606
Present, utilizing ACR system, information on a reward or a prize based on a result of the selections of the predicted outcomes from viewer and one or more other viewers, where the information on the reward or prize is also presented on the paired device
607
End

FIG. 6

METHOD AND SYSTEM FOR OUTCOME PREDICTION UTILIZING AUTOMATIC CONTENT RECOGNITION

CROSS-REFERENCE TO RELATED APPLICATIONS/INCORPORATION BY REFERENCE

This patent application makes reference to, claims priority to, and claims benefit from U.S. Provisional Application Ser. No. 61/596,012, which was filed on Feb. 7, 2012.

This application makes reference to:

U.S. patent application Ser. No. 13/730,359 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,422 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,459 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,495 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,530 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,754 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,559 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,579 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,593 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,759 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,627 filed on Dec. 28, 2012;
U.S. patent application Ser. No. 13/730,644 filed on Dec. 28, 2012;
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U.S. patent application Ser. No. 13/730,691 filed on Dec. 28, 2012;
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U.S. patent application Ser. No. 13/730,718 filed on Dec. 28, 2012; and
U.S. patent application Ser. No. 13/730,734 filed on Dec. 28, 2012.

Each of the above stated applications is hereby incorporated herein by reference in its entirety.

FIELD OF THE INVENTION

Certain embodiments of the invention relate to content recognition. More specifically, certain embodiments of the invention relate to a method and system for outcome prediction utilizing automatic content recognition.

BACKGROUND OF THE INVENTION

Smart or connected televisions (TVs) may receive data from data networks such as Internet networks that allow a viewer to not only access broadcast digital content, but also receive multimedia content. In addition viewers without Smart TVs can access additional content via a smart phone or tablet. With the proliferation of connected TVs and wireless communication devices such as smartphones and tablets, content or network providers now have a plethora of avenues for distributing media including programming, advertisements and interactive content.

Further limitations and disadvantages of conventional and traditional approaches will become apparent to one of skill in the art, through comparison of such systems with the present invention as set forth in the remainder of the present application with reference to the drawings.

BRIEF SUMMARY OF THE INVENTION

A system and/or method for outcome prediction utilizing automatic content recognition, substantially as shown in and/or described in connection with at least one of the figures, as set forth more completely in the claims.

Various advantages, aspects and novel features of the present invention, as well as details of an illustrated embodiment thereof, will be more fully understood from the following description and drawings.

BRIEF DESCRIPTION OF SEVERAL VIEWS OF THE DRAWINGS

FIG. **1**A is a block diagram illustrating an exemplary communication system, in accordance with an embodiment of the invention.

FIG. **1**B is a high-level block diagram illustrating an exemplary automatic content recognition system with an abstraction layer, in accordance with an embodiment of the invention.

FIGS. **2**A-**2**C are each a block diagram that illustrates details of the exemplary automatic content recognition system with an abstraction layer shown in FIG. **1**B, in accordance with embodiments of the invention.

FIGS. **3**A-**3**C are block diagrams illustrating an exemplary outcome prediction utilizing automatic content recognition, in accordance with an embodiment of the invention.

FIGS. **4**A-**4**C are block diagrams illustrating an exemplary outcome prediction competition utilizing automatic content recognition, in accordance with an embodiment of the invention.

FIG. **5** is a flow chart illustrating exemplary steps for outcome prediction utilizing automatic content recognition, in accordance with an embodiment of the invention.

FIG. **6** is a flow chart illustrating exemplary steps for outcome prediction competition utilizing automatic content recognition, in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Certain embodiments of the invention can be found in a method and system for outcome prediction utilizing automatic content recognition. In various embodiments of the invention, an automatic content recognition (ACR)-enabled connected device may be operable to identify, utilizing an ACR system, an event that is to take place in a presented program associated with a network. The ACR-enabled connected device may be paired with or associated with a paired device utilizing a companion application running on the paired device. In the absence of a connected TV utilizing an ACR system a connected device such as a smart phone or tablet may independently listen to the program audio and utilize an ACR system inside the companion application. In this way a paired device may be paired simply by listening to the audio corresponding to the video being displayed on the TV. An overlay may be presented by the ACR-enabled connected device, utilizing the ACR system, for a viewer to

interact within a specific time window synchronized with the identified event. In this regard, the overlay may comprise information on possible outcomes of the identified event and the overlay may also be presented on the paired device, for example. The ACR-enabled connected device may be operable to identify, utilizing the ACR system, a predicted outcome selected by the viewer. In this regard, the predicted outcome may be selected by the viewer, within the specific time window, via interaction with the overlay on the ACR-enabled connected device or on the paired device. An actual outcome that actually takes place may then be identified by the ACR-enabled connected device utilizing the ACR system. The ACR-enabled connected device may be operable to present, utilizing the ACR system, a message indicating whether the viewer is correct or incorrect in the selection based on the identified actual outcome, and the message may also be presented on the paired device. In instances when the viewer is correct in the selection, information on a reward or a prize may be presented by the ACR-enabled connected device utilizing the ACR system, and the information on the reward or the prize may also be presented on the paired device.

In an exemplary embodiment of the invention, the overlay may also comprise information on options for the viewer to compete with one or more other viewers who also participate in the selection of the predicted outcome. In this regard, the overlay may be presented, via the ACR system, to each of the one or more other viewers, within the specific time window which is synchronized with the identified event in the program that is presented to each of the one or more other viewers. The ACR-enabled connected device may then be operable to present, utilizing the ACR system, information on a reward or a prize based on a result of the selections of the predicted outcomes from the viewer and from the one or more other viewers. The information on the reward or the prize may also be presented on the paired device.

In an exemplary embodiment of the invention, the presented program may comprise a sports program or game such as American football. In this regard, the identified event may comprise a play in the sports program or game such as, for example, a play in the American football sports program. The possible outcomes may comprise, for example, a pass, a run, a punt, a touchdown, a field goal attempt, a made field goal, a missed field goal, a turnover, etc., associated with the play in the American football sports program.

FIG. **1**A is a block diagram illustrating an exemplary communication system, in accordance with an embodiment of the invention. Referring to FIG. **1**A, there is shown an ACR system **100**, a network provider **102**, a communication network **103**, a service provider **104**, a set-top box (STB) **105** and ACR-enabled devices **140**. The ACR-enabled devices **140** may comprise an ACR-enabled connected device **141** and a paired device **143**. If the connected TV device **141** is in fact a legacy non-connected TV not capable of running an ACR service then the pairing of device **143** would be established through listening to the program audio. The ACR-enabled connected device **141** may comprise an ACR module **142**. The paired device **143** may comprise a companion application **144**. The ACR-enabled connected device **141** may be a TV.

The ACR system **100** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to support automatic content recognition operations in the ACR-enabled devices **140** such as the ACR-enabled connected device **141**. The ACR system **100** may provide automatic content recognition applications and/or services to the ACR-enabled devices **140**. The ACR system **100** may support a plurality of automatic content recognition technologies and may provide appropriate synchronization to the ACR-enabled connected device **141** and/or to the corresponding paired device **143**. For example, the ACR system **100** may implement an abstraction layer to support a plurality of different fingerprinting technologies for the automatic content recognition. In this regard, the ACR system **100** may utilize fingerprints to identify content. More details of the operation of the ACR system **100** may be described below with respect to, for example, FIGS. **1**B, **2**A-**2**C.

In an exemplary embodiment of the invention, the ACR system **100** may be operable to support an outcome prediction operation of the ACR-enabled connected device **141**.

The network provider **102** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to generate, capture and/or package content such as TV programming or multimedia content that may be distributed to display devices such as the ACR-enabled devices **140**. For example, the content may be distributed to the ACR-enabled connected device **141** via the service provider **104** and the STB **105** or via the communication network **103**. In an exemplary embodiment of the invention, the network provider **102** may provide content to the ACR system **100** for supporting the automatic content recognition operation.

The communication network **103** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to provide communication among a plurality of entities via various wire-line and/or wireless technologies such as, for example, T1/E1, DSL, cable modem, FTTx, PLC and/or WiMAX. The communication network **103** may comprise, for example, Internet and/or other multimedia network.

The service provider **104** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to provide services using different access technologies to display devices such as the ACR-enabled devices **140**. For example, the service provider **104** may provide connections to the ACR-enabled connected device **141** via the STB **105**. Such connections may be utilized by the ACR-enabled connected device **141** to access content provided by the network provider **102**.

The STB **105** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to connect a display device such as the ACR-enabled connected device **141** to an external source of signals, such as the service provider **104**, and to convert those signals into content that may be displayed on the screen of the ACR-enabled connected device **141**. The STB **105** may be operable to provide processing associated with managing, delivering, and/or storing video content that may be displayed on the ACR-enabled connected device **141**.

The ACR-enabled connected device **141** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to receive content for presenting to a viewer such as the viewer **106**. The content may comprise interactive content for the viewer **106** to interact. In addition to receiving content via the service provider **104** and the STB **105**, the ACR-enabled connected device **141** may receive content from Internet via the communication network **103**. In an exemplary embodiment of the invention, the ACR-enabled connected device **141** may comprise an ACR module **142**. The ACR module **142** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to provide automatic content recognition functions for the ACR-enabled connected device **141**. The ACR module **142** may communicate with the ACR system **100**, via the communication network **103**, to support the automatic content recognition operations of the ACR-enabled connected device **141**. For example, the ACR

module **142** may support the automatic content recognition operations on video content provided by the network provider **102** via the service provider **104**, or on video content being played back from a digital video recorder (DVR) or the like device. The ACR module **142** may, for example, provide fingerprints to the ACR system **100** for matching. The ACR module **142** may receive ACR related information or content from the ACR system **100**, for example.

In an exemplary embodiment of the invention, the ACR module **142** may be operable to identify, utilizing the ACR system **100**, an event that is to take place in a presented program associated with a network. The ACR module **142** may be operable to present an overlay, utilizing the ACR system **100**, for a viewer **106** to interact within a specific time window synchronized with the identified event. In this regard, the overlay may comprise information on possible outcomes of the identified event. The ACR module **142** may be operable to identify, utilizing the ACR system **100**, a predicted outcome or outcomes selected by the viewer **106**, with respect to a given event. In this regard, the predicted outcome(s) may be selected by the viewer **106**, within the specific time window, via interaction with the overlay on the ACR-enabled connected device **141** or on the paired device **143**. An actual outcome that actually takes place may then be identified by the ACR module **142** utilizing the ACR system **100**. The ACR module **142** may be operable to present, utilizing the ACR system **100**, a message in an overlay indicating whether the viewer **106** is correct or incorrect in the selection based on the identified actual outcome or outcomes. In instances when the viewer **106** is correct in the selection, the ACR module **142** may present, utilizing the ACR system **100**, information on a reward or a prize, and the information on the reward or the prize.

In an exemplary embodiment of the invention, the overlay may also comprise information on options for the viewer **106** to compete with one or more other viewers **107** who may also participate in the selection of the predicted outcome. In this regard, the overlay may be presented, via the ACR system **100**, to each of the one or more other viewers **107**, within the specific time window, which may be synchronized with the identified event in the program that is presented to each of the one or more other viewers **107**. The ACR module **142** may then present, utilizing the ACR system **100**, information on a reward or a prize based on a result of the selections of the predicted outcomes from the viewer **106** and from the one or more other viewers **107**.

The paired device **143** may comprise suitable logic, circuitry, interfaces and/or code that may be operable to pair with the ACR-enabled connected device **141** for automatic content recognition operations, including but not limited to second screen operations. Communication between the ACR-enabled connected device **141** and the paired device **143** may occur via a wireless communication protocol such as, for example, near field communication (NCF). The paired device **143** may pair with the ACR-enabled connected device **141** utilizing the companion application **144** downloaded in the paired device **143**. For example, the companion application **144** may comprise a sync application downloaded in the paired device **143** from the ACR-enabled connected device **141**. The paired device **143** may comprise, for example, a tablet, a laptop and/or a smartphone.

In operation, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, an event that is to take place in a presented program associated with a network. The ACR-enabled connected device **141** may be paired with or associated with a paired device **143** utilizing a companion application **144** downloaded in and running on the paired device **143**. The ACR module **142** in the ACR-enabled connected device **141** may be operable to present an overlay, utilizing the ACR system **100**, for a viewer **106** to interact within a specific time window synchronized with the identified event. In this regard, the overlay may comprise information on possible outcomes of the identified event and the overlay may also be presented on the paired device **143**, for example.

The ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, a predicted outcome or outcomes selected by the viewer **106**. In this regard, the predicted outcome(s) may be selected by the viewer **106**, within the specific time window, via interaction with the overlay on the ACR-enabled connected device **141** or on the paired device **143**. An actual outcome that actually takes place may then be identified by the ACR module **142** in the ACR-enabled connected device **141**, utilizing the ACR system **100**. The ACR module **142** in the ACR-enabled connected device **141** may be operable to present, utilizing the ACR system **100**, a message in an overlay indicating whether the viewer **106** is correct or incorrect in the selection based on the identified actual outcome, and the message may also be presented on the paired device **143**. In instances when the viewer **106** is correct in the selection, the ACR module **142** in the ACR-enabled connected device **141** may present, utilizing the ACR system **100**, information on a reward or a prize, and the information on the reward or the prize may also be presented on the paired device **143**.

In an exemplary embodiment of the invention, the overlay may also comprise information on options for the viewer **106** to compete with one or more other viewers **107** who may also participate in the selection of the predicted outcome. In this regard, the overlay may be presented, via the ACR system **100**, to each of the one or more other viewers **107**, within the specific time window, which may be synchronized with the identified event in the program that is presented to each of the one or more other viewers **107**. The ACR module **142** in the ACR-enabled connected device **141** may then present, utilizing the ACR system **100**, information on a reward or a prize based on a result of the selections of the predicted outcomes from the viewer **106** and from the one or more other viewers **107**. The information on the reward or the prize may also be presented on the paired device **143**. In an exemplary embodiment of the invention, the presented program may comprise a sports program or game such as American football. In this regard, the identified event may comprise, for example, a play in the American football sports program or game. The possible outcomes may comprise a pass, a run, a punt, a touchdown, a field goal attempt, a made field goal, a missed field goal, a turnover, etc., associated with the play, for example.

FIG. **1B** is a high-level block diagram illustrating an exemplary automatic content recognition system with an abstraction layer, in accordance with an embodiment of the invention. Referring to FIG. **1B**, there is shown an ACR system **100** that implements an abstraction layer to support fingerprinting technology from multiple vendors. The ACR system **100** is operable to support fingerprinting technology from multiple vendors and may be utilized to identify a network television station that provides content for display on a viewing screen based on the logo, symbol, sign, watermark, and/or text that are typically utilized to represent the network television station.

The ACR system **100** may comprise an offline fingerprint module **110**, a monitor application module **115**, a real-time event manager (RTEM) **120**, a plurality of RTFSs **122**, . . . , **124**, fingerprint match systems **130**, end-user devices **140**, an applications and analytics module **150**, and a timeline/event

creation module **160**. In some instances, at least some of the functions of the monitor application module **115** and of the RTEM **120** may be combined and may be provided by a common device or component of the ACR system **100**.

The ACR system **100** may also comprise an NTP server **170** that is operable to provide synchronization to various parts of the ACR system **100** via a common reference clock. For example, the NTP server **170** may be operable to synchronize the operation of the RTEM **120** with the operation of the RTFSs **122**, . . . , **124**. The operations of the NTP server **170** may be based on, for example, the Internet Engineering Task Force (IETF) RFC 5905 "Network Time Protocol Version 4: Protocol and Algorithms Specification."

The offline fingerprint module **110** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to handle the offline fingerprinting portion of the operations performed by the ACR system **100**. The offline fingerprint module **100** may be operable to receive pre-recorded or offline content such as commercials, programs, and promotions, for example. In this regard, the offline fingerprint module **100** may be able to ingest and process content with defined interactivity. The monitor application module **115** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to process a network television feed and the content handled by the offline fingerprint module **110** to create a real-time timeline and/or real-time event triggers. During the process, the monitor application module **115**, and/or the timeline/event creation module **160**, may interact with backend analytics databases that comprise user-engagement data, for example. Some of the operations that may be performed by the offline fingerprint module **110** may comprise, for example, ingest operations, storage operations, monitoring operations, and/or content version comparison operations.

The RTEM **120** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to manage real-time events based on inputs provided by one or more sources. For example, the RTEM **120** may be operable to manage real-time events based on events stored in an interactive timeline archive, a network schedule, and/or those provided by an interactive director that may assign interactive event IDs to live programming as the network television feed is being fingerprinted in real time. Moreover, the RTEM **120** may be operable to trigger interactive events in legacy systems and/or in web-based systems. The RTEM **120** may be referred to as a real-time event trigger infrastructure, for example. The RTEM **120** may comprise a real-time event inserter (RTEI) (not shown), which is operable to insert the events into the RTFSs **122** . . . **124**.

In accordance with an embodiment of the invention, the RTEM **120** may be operable to instruct the monitor application module **115**, and/or the timeline/event creation module **160** to record the fingerprints associated with a live program as well as to store the corresponding set of events created during the live program in the interactive timelime archive. This enables playback of the program with interactivity even after expiration of the corresponding fingerprints in the vendor's third party database. This may occur in instances when there is a re-broadcast of the live event at a subsequent date. In the case of timeline based devices, the events may be stored and timeline retrieval may be enabled even during the active window of the corresponding fingerprints since there will be no available event-to-fingerprint association.

In accordance with an embodiment of the invention, the RTEM **120** may be operable to receive one or more inputs from a user (e.g., an interactive director), and to generate based on those inputs, interactive event identifiers that can be communicated to the fingerprint servers where they can be associated with or assigned to the video fingerprints generated by the fingerprint servers. The RTEM **120** may be operable to communicate the interactive event identifiers to a television system (e.g., legacy system) and/or to a web system. The interactive event identifiers may be utilized in the television system and/or in the web system to trigger interactive events. Moreover, the communication of the interactive event identifiers may be based on one or more of an EBIF, an HTTP live streaming (HLS), a satellite network protocol, or some other protocol.

In an embodiment of the invention, the Real-time event manager **120** may be operable to generate one or more signals that provide instructions to the RTFSs **122**, . . . , **124** to enable the identification of a network television station based on the logo, symbol, sign, watermark, and/or text that are typically utilized to represent the network television station. The instructions may be related to information that is to be generated and/or provided to the end-user devices **140** for network television station identification. The instructions may indicate the type of information that is to be provided to the end-user devices **140** and/or when such information is to be provided. In some instances, a portion of the ACR system **100** other than the Real-time event manager **120**, or in conjunction with the Real-time event manager **120**, may generate the signals for providing instructions to the RTFSs **122**, . . . , **124**.

The RTFSs **122**, . . . , **124** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to handle fingerprinting and fingerprint communications to the fingerprint match systems **130**. Since each vendor or television manufacturer is likely to utilize its own fingerprint technology, each of the RTFSs **122**, . . . , **124** may be a dedicated server for each of the fingerprint technologies supported by the ACR system **100**. In some embodiments of the invention, a portion of the RTFSs **122**, . . . , **124** may be operable to perform video fingerprinting while the remaining portion of the RTFSs **122**, . . . , **124** may be operable to perform audio fingerprinting or some combination thereof. Fingerprint technologies from multiple vendors may utilize different computations to perform fingerprinting of video and/or audio frames. For example, each fingerprint technology may utilize a specific set of algorithms, parameters, operations, and/or data processing methods, for example.

In an embodiment of the invention, the RTFSs **122**, . . . , **124** may be operable to receive one or more signals from the Real-time event manager **120** and/or from another portion of the ACR system **100** to enable the identification of a network television station based on the logo, symbol, sign, watermark, and/or text that are typically utilized to represent the network television station. The instructions may be utilized to determine and/or provide locations to the end-user devices **140** to take fingerprints of the video content being displayed on a viewing screen. In some instances, at least a portion of the fingerprinting locations may be provided by the Real-time event manager **120** and/or by another portion of the ACR system **100** through the instructions received by the RTFSs **122**, . . . , **124**. In other instances, the fingerprinting locations may be determined by the RTFSs **122**, . . . , **124** based on locally and/or remotely stored information. Each fingerprinting location may comprise coordinates in a video frame (e.g., x coordinates, y coordinates) that indicate a particular region in the video frame to fingerprint.

The RTFSs **122**, . . . , **124** may provide the fingerprinting locations for communication to the end-user devices **140**, for example, in the form of fingerprint profiles. The fingerprint profiles may comprise fingerprinting locations and/or other information to be utilized by an end-user device for ACR

fingerprinting. In some instances, the fingerprint profiles may be generated by the RTFSs **122**, . . . , **124** in response to the instructions received. In other instances, the fingerprint profiles comprising the fingerprinting locations may be received by the RTFSs **122**, . . . , **124** from the Real-time event manager **120** and/or from another portion of the ACR system **100**. The fingerprint profile of a particular end-user device **140** may be updated based on an indication that additional and/or different locations may be needed during fingerprinting to identify the network television station logo or symbol being displayed on a viewing screen at the end-user device **140**. The update may be generated by the corresponding RTFS and then communicated to the end-user device **140** or may be received by the corresponding RTFS from the Real-time event manager **120** and/or from another portion of the ACR system **100** and then communicated to the end-user device **140**.

The indication that a fingerprint profile update may be needed may be the result of network operations that recognize that certain content is being broadcast by several network television stations concurrently (e.g., State of the Union address). In such instances, the fingerprinting locations being utilized may not analyze the region in a video frame where the logo of the network television station is displayed. Thus, providing additional fingerprinting locations in this region may enable detection and identification of the logo and, consequently, of the network television station.

The indication that a fingerprint profile update may be needed may also be the result of feedback provided by an end-user device **140**. The feedback may indicate, for example, that the content being displayed has been identified but that the content may have originated in any one of several sources and the particular source of the content has not been identified. In such instances, the fingerprinting locations being utilized may not analyze the region in a video frame where the logo of the network television station is displayed. Thus, providing additional fingerprinting locations in this region may enable detection and identification of the logo and, consequently, of the source of the content.

In some instances, the fingerprint profile and/or the fingerprint profile update received by an end-user device may comprise information that indicates to the end-user device that any additional fingerprinting locations may be utilized automatically when the source (e.g., network television station) of a particular content is not initially identified.

In one or more embodiments of the invention, the RTFSs **122**, . . . , **124** may be operable to communicate fingerprint profiles and/or fingerprint profile updates to the end-user devices **140** through the fingerprint match systems **130**. Feedback and/or queries from the end-user devices **140** may be received by the RTFSs **122**, . . . , **124** for processing. The RTFSs **122**, . . . , **124** may in turn communicate information corresponding to the feedback and/or queries from the end-user devices **140** to the Real-time event manager **120** and/or to another portion of the ACR system **100** for further processing.

The fingerprint match systems **130** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to enable hosted services in the Internet for matching fingerprints produced by the RTFSs **122**, . . . , **124** with fingerprints produced by the end-user devices **140**. Each of the fingerprint match systems **130** corresponds to a particular ACR or fingerprint technology. In this regard, each of the fingerprint match systems **130** may be supported by a third party such as a TV manufacturer, for example.

The fingerprint match systems **130** may be operable to compare fingerprints produced by the end-user devices **140** with fingerprints provided by the RTFSs **122**, . . . , **124**. When matches occur, the fingerprint match systems **130** may indicate that interactive events are to take place in the end-user devices **140**. These interactive events may allow a viewer to be presented with information on the screen or display of an ACR-based device and to interact with the device based on the information presented.

The end-user devices **140** may comprise a plurality of devices such as connected TVs, connected TV with paired devices (e.g., tablets), and second screen devices such as smartphones and tablets, for example. The ACR-based devices may be referred to as end-user devices, for example. Since each of the fingerprint match systems **130** supports a different ACR or fingerprint technology, those end-user devices **140** that support a particular fingerprint technology are operable to communicate with the corresponding fingerprint match systems **130** that support the same fingerprint technology. Moreover, when a secondary or paired device that supports a particular fingerprint technology is used, that device may also be able to communicate with the corresponding fingerprint match system **130** that supports the compatible fingerprint technology.

The end-user devices **140** may be operable to receive and utilize a fingerprint profile and/or a fingerprint profile update and to take fingerprints in a pre-determined number of locations in a video frame. Each fingerprinting location may be defined by a set of coordinates that describe a region in the video frame where a fingerprint of the video content is to be taken. The end-user devices **140** may be operable to receive a series of fingerprint profiles and/or fingerprint profile updates and may be operable to adjust ACR fingerprinting accordingly.

The applications and analytics module **150** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to provide data to the end-user devices **140**, determine what platforms are to be served and when these platforms are to be served, handle communications with third-party partners and advertisers, handle communication with backend analytics databases, and determine unique responses for a given device request (e.g., fix targeting).

The timeline/event creation module **160** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to produce a timeline of the content in a program or show based on information provided by the monitor application module **115**. The timeline/event creation module **160** may then provide the timeline created to the applications and analytics module **150** to have the timeline disseminated to the appropriate End-user devices **140** that may not support event-to-fingerprint association. Once the End-user devices **140** have the timeline for a particular program or show, they may monitor the program or show, relative to the timeline, and launch appropriate event requests when a specified point in the timeline indicates that a particular event is to take place.

Communication between the RTFSs **122**, . . . , **124**, and the fingerprint match systems **130** may occur through one or more wireless and/or wireline communication links. Similarly, communications between the fingerprint match systems **130** and the end-user devices **140** and/or the applications and analytics module **150** may occur through one or more wireless and/or wireline communication links. The communication links described above may support one or more communication protocols. For example, communication protocols based on Internet Protocol (IP) may be typically used. Accordingly, the RTFSs **122**, . . . , **124**, the fingerprint match systems **130**, and the applications and analytics module **150** may comprise suitable logic, circuitry, code, and/or interfaces to enable the use of the communication protocols.

In operation, the monitor application module **115** and/or the RTEM **120** may generate and/or handle event identifiers

or event triggers that correspond to specific times in a program. These event identifiers may be generated from live programming, from a network schedule, or from information provided by the offline fingerprint module **110**. The event identifiers may be assigned to the appropriate fingerprints generated by the RTFSs **122**, . . . , **124**. Since each RTFS relies on a different fingerprint technology, system synchronization is needed to appropriately assign the event identifiers to the right spot on a video and/or audio sequence. Such synchronization may be achieved by the use of a common reference clock provided by the NTP server **170**.

Each of the RTFSs **122**, . . . , **124** may communicate the event identifiers and the fingerprints to its corresponding one of the fingerprint match systems **130**. The fingerprint match systems **130** in turn receive fingerprints from their corresponding end-user devices **140** and try to match those fingerprints to the ones received from their corresponding RTFSs **122**, . . . , **124**. When a match occurs, the event identifier and/or other information may be passed to the appropriate ACR-based device. With this information, the ACR-based device may obtain, for example, interactive information (e.g., graphics) from the applications and analytics module **150**. For example, a connected TV may receive code or data specific for that device from a content management system (CMS) via a cloud-based content delivery network (CDN). There may be other actions performed by the user in connection with the interactive event and/or other information presented or produced in connection with the interactive event.

In operation, the ACR system **100** may generate a fingerprint profile that may be communicated to one of the end-user devices **140**. The fingerprint profile may be communicated through one or more of the Real-time event manager **120**, one of the RTFSs **122**, . . . , **124**, and one of the fingerprint match systems **130**. The fingerprint profile may comprise locations where the end-user device is to take fingerprints of the video content being reproduced by the device. Once the content is identified based on the fingerprints taken and subsequently matched in the corresponding fingerprint match system **130**, it may be determined that the source of the content is not known. Knowing the source of the content may be needed in some instances to enable interactive events associated with that source on the end-user device. Otherwise, an interactive event from, for example, one network television station may occur when a viewer is watching programming provided by a different network television station.

When the source of the content is not known, the end-user device may automatically utilize additional locations provided in the fingerprint profile or in a fingerprint profile update. These locations may correspond to the region in the video frame where the network television station logo or symbol is typically placed. Once these fingerprints are taken, they may be compared to fingerprints of the network television station logo or symbol at the corresponding fingerprint match systems **130**. When a match occurs and the logo is identified, the end-user device may be able to receive interactive event identifiers from the corresponding RTFS. Once these interactive event identifiers are received, the end-user device may communicate with the applications and analytics module **150** to enable the interactive events to occur.

FIGS. **2**A-**2**C are each a block diagram that illustrate details of the exemplary automatic content recognition system with abstraction layer shown in FIG. **1**B, in accordance with embodiments of the invention. Referring to FIG. **2**A, there is shown a portion **100***a* of the ACR system **100** that may substantially correspond to at least portions of the offline fingerprint module **110**, the monitor application **115**, and the timeline/event creation module **160** described above with respect to FIG. **1**. The portion **100***a* may comprise a content ingest module **212**, an offline fingerprint ingest server **214**, a content version comparison module **216**, and a fingerprint database **220**. The portion **100***a* may also comprise an interactive timeline creation module **218**, an interactive timeline archive **222**, the monitor application module **115**, and the timeline/event creation module **160**. Also shown are backend databases (DB) **200***a* and **200***b* connected to the timeline/event creation module **160** and a playout server **274** connected to the monitor application module **115**.

The content ingest module **212** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to receive a media master **210**, also referred to as an air master, which may comprise one or more programs, commercials, and/or promotions, for example. The content ingest module **212** may be operable to generate or create a set of proxy videos by encoding the media master **210** utilizing different resolutions. The highest quality proxy video may be provided as an input to the offline fingerprint ingest server **214** while the lowest quality proxy video may be provide to the interactive timeline creation module **218**. The content ingest module **212** may also provide a content ID (CID) and other associated metadata (e.g., program data, frame number) that corresponds to the content in the media master **210**.

The offline fingerprint ingest server **214** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to use a fingerprint computation or algorithm to fingerprint content and subsequently push the fingerprints for archival in the fingerprint database **220**. In the offline fingerprint ingest server **214**, the highest quality proxy video created by the content ingest module **212** may be fingerprinted and may be associated with the content ID and corresponding related metadata. In this regard, the offline fingerprint ingest server **214** may utilize an API to automatically ingest the media files and associated metadata from the content ingest module **212**. A graphical user interface (GUI) may also be supported to manually ingest media files and to enter associated metadata.

The offline fingerprint ingest server **214** may be operable to provide a management interface for the fingerprint database **220** and/or the content version comparison module **216**. For example, an API may be utilized to remove content from the fingerprint database **220**. A GUI may also be supported to manually remove content from the fingerprint database **220**. The offline fingerprint ingest server **214** may be operable to set priorities regarding the content to be ingested and processed. Moreover, the offline fingerprint ingest server **214** may be operable to support, among other features, the use of administration tools and the creation of reports, the ability to generate progress reports on processing content and errors, and/or recoverability after a shut down or crash.

The offline fingerprint ingest server **214** may be implemented utilizing multiple modules (not shown). These modules may be operable to perform one or more functions. Examples of those functions may comprise, without limitation, receiving the content to be fingerprinted in an input or watch folder, receiving and assigning CIDs and processing priority utilizing content ingest management tools, supporting an ACR process for writing fingerprints to the fingerprint database **220**, and supporting administration tools utilized for monitoring and reporting.

The fingerprint database **220**, which may also be referred to as a central fingerprint database, for example, may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to store fingerprints captured by the offline fingerprint ingest server **214** and maintain the association between the captured fingerprints and a particular CID and media time.

In an embodiment of the invention, the fingerprint database **220** may support queries from multiple monitor applications **224**. For example and without limitation, as many as 50 monitor applications **224** may query the fingerprint database **220**. In response to a query, the fingerprint database **220** may return a CID and a media time associated with the fingerprint in a very short period of time, typically in less than one second. For example and without limitation, the return time by the fingerprint database **220** may be less than 10 milliseconds.

The fingerprint database **220** may also be operable to respond to requests from the content version comparison module **216** to identify differences between the master versions in the fingerprint database **220** and derivative works also ingested into the fingerprint database **220**. For example, a movie may have different cuts or versions depending on the time of day and/or the network in which it is to be shown. The corresponding master and the derivative works may be ingested, fingerprinted, and stored in the fingerprint database **220**. The interactive timeline creation module **218** may have access to the various versions of a certain work but it can identify the master version from any of the other cuts or versions. Typically, a request is initiated by the content version comparison module **216** to identify the differences (e.g., deltas) between the master and selected derivative works. A "delta" file is returned to the interactive timeline creation module **218**, which incorporates the changes from the master source and automatically generates a derivative event timeline. Multiple derivative works may be compared to the master in the content version comparison module **216** to reduce the processing necessary to handle the other versions.

The fingerprint database **220** may be implemented as a distributed, fault-tolerant database that is operable to support persistent storage of fingerprints. The fingerprint database **220** may be operable to store large amounts of content fingerprints. For example and without limitation, the fingerprint database **220** may store up to 25,000 hours of content fingerprints. The number of hours of content fingerprints that can be stored may vary based on the availability of storage capacity in the fingerprint database **220**.

The fingerprint database **220** may also be operable to concurrently support the reception of content from multiple offline fingerprint ingest servers **214**, respond to queries from multiple monitor applications **224**, and/or respond to queries from multiple content version comparison modules **216**. For example and without limitation, the fingerprint database **220** may receive content from up to 10 offline fingerprint ingest servers **214**. In another example and without limitation, the fingerprint database **220** may respond to queries from up to 50 monitor applications **224**. In yet another example and without limitation, the fingerprint database **220** may respond to queries from up to five content version comparison modules **216**. The number of requests and/or of content version comparison modules **216** that can be supported by the fingerprint database **220** may vary based on the capacity of the fingerprint database **220**.

The fingerprint database **220** may be operable to support, among other features, administrative tools and report generation, management tools to report errors, and/or recoverability after a shut down or crash.

The fingerprint database **220** may be implemented utilizing multiple modules (not shown). These modules may comprise a fingerprint storage module as well as other modules that are operable to support the process of ingesting content from the offline fingerprint ingest server **214**, the process of responding with a CID and media time to the monitor application module **115**, and/or the process of responding to the content version comparison module **216**. One or more modules may also be implemented to support administrative tools, monitoring, and/or reporting, for example.

The content version comparison module **216** may comprise suitable logic, circuitry, code, and/or interface that may be operable as a tool that enables comparison of a master version of some content to a derivative version of that same content based on fingerprints stored in the fingerprint database **220**. A derivative work or piece may refer to a version of a program, promotion, or commercial, for example, that is different from a master version of that same program, promotion, or commercial. The content version comparison module **216** may return a file listing the differences between the master version and the derivative work based on a time code. The file may be provided to the interactive timeline creation module **218**, for example.

The content version comparison module **216** may be operable to identify sequences that have been edited to shorten the time of handling the derivative work, the insertion of new advertisement break locations, and/or the insertion of new content. An example of the insertion of new advertisement break locations may comprise the addition of black frames of between 5 and 15 seconds. An example of the insertion of new content may occur in instances when the derivative work is the director's cut rather than the original theatrical master. The content version comparison module **216** may pass or communicate a difference file to the interactive timeline creation module **218** to be utilized for automating the creation of a new interactive timeline for a unique edit of a program based on the network, the day, and/or the time of day on which the program is to be shown.

The content version comparison module **216** may also be operable to query the fingerprint database **220** for information (e.g., fingerprints) to perform version comparison, to identify advertisement break locations based on black frames of between 5 and 15 seconds, and/or to generate an extensible markup language (XML) or similar output file that indicates the differences between a derivative piece and a master version. Moreover, the content version comparison module **216** may support, among other features, the use of administration tools and the creation of reports, the ability to generate progress reports on processing content and errors, and/or recoverability after a shut down or crash.

The content version comparison module **216** may be implemented utilizing multiple modules (not shown). These modules may be operable to perform one or more functions such as, for example, querying the fingerprint database **220** and performing file comparison. One or more modules may also be implemented to support administrative tools, for monitoring, and/or reporting, for example. The monitor application module **115** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to ingest a live broadcast television linear video feed and fingerprint the content in the feed in real time. The live broadcast television linear video feed may also be referred to as a network television feed, for example. The live broadcast television linear video feed can be based on a Serial Digital Interface (SDI) video interface and/or on a High-Definition SDI (HD-SDI) video interface. These fingerprints may be compared by the monitor application module **115** against fingerprints stored in the fingerprint database **220**. When the comparison results in a fingerprint match, the fingerprint database **220** may return to the monitor application module **115** the CID and the media time of that match. The CID and the media time may then be provided to the timeline/event creation module **226**. An API may be utilized to handle the communication

between the monitor application module **115** and the timeline/event creation module **226**.

As noted above, the monitor application module **115** may be operable to support, for example, a SDI and/or a HD-SDI for input that are provided from the broadcast chain prior to encoding and uplink. In this regard, the broadcast chain may provide the network television feed to the monitor application module **115**. Other interfaces and/or formats may also be supported.

The monitor application module **115** may function so that it operates ahead of any ACR-based device or viewer device that is in the field, such as in a user's home, for example. Although the amount of time that the monitor application module **115** may be ahead from ACR-based devices in the field may vary, in a typical case the monitor application module **115** may be approximately at least **3** seconds ahead, for example.

The monitor application module **115** may be operable to query the fingerprint database **220** to determine the CID and the media time or media timeline. The monitor application module **115** may be operable to support an API that enables the monitor application module **115** to report the CID and the media time to a real-time event trigger infrastructure that is represented by the label "A" in FIG. **2**A. Moreover, the monitor application module **115** may support, among other features, the use of administration tools and the creation of reports, the use of management tools for reporting errors, and/or the handling of failover/recovery operations.

The monitor application module **115** may be implemented utilizing multiple modules (not shown). These modules may comprise a module for video capture from an SDI/HD-SDI capture card, a module that provides real-time fingerprinting and querying of the fingerprint database **220**, and a module that supports an API to communicate the CID, media time, and other data (e.g., duplicate CIDs, mediatime, confidence, number of seconds). One or more modules may also be implemented to support administrative tools, monitoring, and/or reporting, for example.

The timeline/event creation module **226**, which may be implemented as part of the monitor application **226**, may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to query the interactive timeline archive **222** for events associated with the CID. The timeline/event creation module **226** may be operable to utilize the CID and the media time received by the monitor application module **115** from the fingerprint database **220** to look up event IDs in the interactive timeline archive **222**. The event IDs are used to create a real-time timeline (i.e., schedule) in XML or other standard data format and real-time event triggers.

The interactive timeline creation module **218** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to utilize the proxy video generated by the content ingest module **212** and link an interactive timeline against the fingerprinted media. The interactive timeline may comprise one or more event IDs associated with a particular time in a program, commercial, or promotion. The interactive event IDs may be referred to as interactive event IDs, for example. The interactive timeline archive **222** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to store multiple interactive timelines.

In operation, the air master **210** is received and ingested by the content ingest module **212** and a proxy video is created. The highest quality proxy video generated by the content ingest module **212** may be provided to the offline fingerprint ingest server **214** while a lower quality proxy video generated by the content ingest module **212** may be provided to the interactive timeline creation module **218**. The offline fingerprint ingest server **214** may fingerprint the high quality proxy video and may send the fingerprints to the fingerprint database **220** for archiving. In addition to the fingerprints, CIDs and media times may be stored in the fingerprint database **220**.

The interactive timeline creation module **218** may receive the proxy video and may link event IDs that represent certain desired interactive events with the program's timeline to generate an interactive timeline. The interactive timeline may be stored in the interactive timeline archive **222**.

When a derivative piece or different version from a master version is ingested, the content version comparison module **216** may compare fingerprints of the master version with fingerprints from the derivative piece to generate a difference file that is provided to the interactive timeline creation module **218**. The interactive timeline creation module **218** may utilize the difference file to create an interactive timeline for the derivative piece from an interactive timeline previously generated for the master version.

The monitor application module **115** receives a network television feed and fingerprints the video content in the feed. The fingerprints generated are compared to those stored in the fingerprint database **220** to obtain CIDs media times, and potentially to act when a match is detected. The interactive timeline archive **222** may be queried to obtain event IDs associated with the CIDs. When event IDs are obtained, the timeline/event creation module **226** may generate a real-time timeline XML (or similar data format) feeds and may also generate real-time event triggers that may be communicated to a real-time event trigger infrastructure.

Referring to FIG. **2**B, there is shown a portion **100***b* of the ACR system **100** that may comprise the RTEM **120**, video RTFSs **240**, **242**, and **244**, an audio RTFS **246**, video fingerprint vendors **250**, **252**, and **254**, and an audio fingerprint vendor **256**. The number of video RTFSs and corresponding video fingerprint vendors as well as the number of audio RTFSs and corresponding audio fingerprint vendors shown in FIG. **2**B are provided by way of illustration and not of limitation. More or fewer video RTFSs and corresponding video fingerprint vendors may be utilized in the ACR system **100**. Similarly, the ACR system **100** may utilize more or fewer audio RTFSs and corresponding audio fingerprint vendors than those shown in FIG. **2**B. The NTP server **170** of FIG. **1** is shown providing reference timing to the RTEM **120** and the RTFSs **240**, **242**, **244**, and **246**.

Also shown in FIG. **2**B are various viewer devices such as connected TVs with paired devices **260** and **262**, connected TVs without paired devices **264**, and mobile devices **266**, such as smartphones (e.g., iPhone, Android, etc.) and tablets (e.g., iPad, Samsung Galaxy, etc.). A paired device associated with the connected TVs may be a tablet, smartphone, or other like devices, for example.

The viewer devices **260** may be operable to utilize the same video fingerprinting technology (e.g., video ACR) utilized by the video RTFS **240** and supported by the video fingerprint vendor **250**. The video fingerprint vendor **250** may be a vendor, manufacturer, or other third-party service provider that may comprise suitable logic, circuitry, code, and/or interfaces operable to provide hosted services over the Internet (e.g., cloud computing, etc.) for the viewer devices **260**. These services may comprise video fingerprint matching as well as the delivery of any interactive event IDs associated with a match. In addition, the video fingerprint vendor **250** may provide a network television station identifier and/or network timing information (e.g., heartbeat message or NTP-based network timestamp) that may be utilized by the viewer devices **260** for ACR-related applications and/or to maintain

synchronization with the network television feed. The viewer devices **260** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to take and send video fingerprints to the video fingerprint vendor **250** for matching.

The viewer devices **262** may be operable to utilize the same video fingerprinting technology utilized by the video RTFS **242** and supported by the video fingerprint vendor **252**. The video fingerprinting technology utilized by the viewer devices **262** may be different from that utilized by the viewer devices **260**. The video fingerprint vendor **252** may be a vendor, manufacturer, or other third-party service provider that may comprise suitable logic, circuitry, code, and/or interfaces operable to provide hosted services over the internet for the viewer devices **262**. These services may comprise video fingerprint matching as well as the delivery of any interactive event IDs associated with a match. In addition, the video fingerprint vendor **252** may provide a network television station identifier and/or network timing information that may be utilized by the viewer devices **262** for ACR-related applications and/or to maintain synchronization with the network television feed. The viewer devices **262** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to take and send video fingerprints to the video fingerprint vendor **252** for matching.

The viewer devices **260** and **262** may be operable with a second device (e.g., smartphones, tablets) that may be paired to the parent device. In this regard, the second device may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to take and send video and/or audio fingerprints to a corresponding video fingerprint vendor for matching or enable suitable pairing with the parent device to provide analogous functionality.

The viewer devices **264** may utilize the same video fingerprinting technology utilized by the video RTFS **244** and supported by the video fingerprint vendor **254**. The video fingerprint vendor **254** may be a vendor, manufacturer, or other third-party service provider that may comprise suitable logic, circuitry, code, and/or interfaces operable to provide hosted services over the Internet for the viewer devices **264**. These services may comprise video fingerprint matching as well as the delivery of any interactive event IDs associated with a match. In addition, the video fingerprint vendor **254** may provide a network television station identifier and/or network timing information that may be utilized by the viewer devices **264** for ACR-related applications and/or to maintain synchronization with the network television feed. The viewer devices **264** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to take and send video fingerprints to the video fingerprint vendor **254** for matching.

The viewer devices **266** may utilize the same audio fingerprinting technology (e.g., audio ACR) utilized by the audio RTFS **246** and supported by the audio fingerprint vendor **256**. The viewer devices **266** may be referred to as second-screen devices, for example. The audio fingerprint vendor **256** may be a vendor, manufacturer, or other third-party service provider that may comprise suitable logic, circuitry, code, and/or interfaces operable to provide hosted services over the Internet for the viewer devices **266**. These services may comprise audio fingerprint matching as well as the delivery of any interactive event IDs associated with a match. In addition, the audio fingerprint vendor **256** may provide a network television station identifier and/or network timing information that may be utilized by the viewer devices **260** for ACR-related applications and/or to maintain synchronization with the network television feed. The viewer devices **266** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to take and send audio fingerprints to the audio fingerprint vendor **256** for matching.

The RTFSs **240**, . . . , **246** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to perform fingerprinting of content received from the network television feeds. Each video RTFS may utilize a different video fingerprinting technology or computation from that utilized by the other video RTFSs. Similarly, when more than one audio RTFS is utilized, its audio fingerprint technology or computation may be different from that utilized by the other audio RTFSs. That is, since each vendor supports a different technology for handling fingerprinting, dedicated RTFSs may be needed for each vendor and for that vendor's corresponding viewer devices. The RTFSs **240**, . . . , **246** may be operable to send fingerprints, interactive event IDs, television network station identifiers, and/or network timing information to their corresponding fingerprint vendors through one or more networks (e.g., wireline networks, wireless networks) and/or by utilizing one or more communication protocols.

The RTEM **120** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to perform real-time event triggering. In this regard, the RTEM **120** may be operable to manage real-time events based on inputs from different sources. For example, the RTEM **120** may comprise a pre-recorded event trigger module **232** to provide real-time triggering from the monitor application module **115**, a time-scheduled event trigger module **234** to schedule the occurrence of a trigger based on a broadcast schedule, and a live event trigger module **236**, each of which is operable to handle a different type of input.

The pre-recorded event trigger module **232** may be operable to receive real-time event triggers from the timeline/event creation module **226** described above with respect to FIG. **2**A. These interactive event IDs may be stored in the interactive timeline archive **222** and may be utilized by the pre-recorded event trigger module **232** to assign interactive events via defined APIs to fingerprints generated as the network television feeds are fingerprinted by the RTFSs **240**, . . . , **246**.

The time-scheduled event trigger module **234** may be operable to receive a network or broadcast schedule and to assign, based on the network schedule, interactive events to fingerprints generated as the network television feed is fingerprinted by the RTFSs **240**, . . . , **246**. The network or broadcast schedule can be in XML format or in some other structured data format, for example.

The live event trigger module **236** may be operable to received interactive event IDs assigned by an interactive director to live programming. The interactive director may be an operator that is responsible for inserting events into the live broadcast. For pre-produced content, for example, the interactive director may watch an episode and may determine when an interactive element is to take place, when to push a trivia question, when to push a fun fact, when to drive social engagement, and/or when to share a clip or post a comment. For live content, for example, the interactive director may determine when to trigger a poll question and may manage the prompting of interactive games and determine when to trigger particular questions to engage viewers in a friendly competition. For advertisement, for example, the interactive director may determine when to bring up an offer, when to prompt to prepare for interaction or interaction event, and/or determine how long to leave interactive content on screen based on frequency rules and/or time of day. When advertisement is pre-fingerprinted, for example, interactive advertisement activities may occur automatically.

The RTEM **120** may also be operable to trigger interactive events in legacy television systems and/or in web-based systems. The infrastructure provided by the RTEM **120** may support the triggering of interactive events against applications and set-top boxes (STBs) via enhanced television binary interchange format (EBIF), hypertext transfer protocol (HTTP) live streaming (HLS) via ID3 tags, and satellite delivery systems (e.g., DISH, DirectTV) via the appropriate mechanism on the corresponding STB software platform. For HLS an ID3 tag may be utilized for sending interactive event IDs, for example.

The RTEM **120** may be operable to assign interactive event IDs to particular fingerprints in a sequence of audio or video fingerprints generated by the RTFSs **240**, . . . , **246**. The RTEM **120** may also be operable to provide television network station identifiers and/or network timing information associated with any sequence of fingerprints.

In the example shown in FIG. **2**B, the RTFSs **240**, . . . , **246** may correspond to the RTFSs **122**, . . . , **124**, the fingerprint vendors **250**, . . . , **256** may correspond to the fingerprint match systems **130**, and the viewer devices **260**, . . . , **266** may correspond to the ACR-based devices **140**, which are illustrated in FIG. **1**.

In operation, the RTEM **120** may generate and/or handle one or more interactive event IDs that correspond to a particular set of fingerprints generated by the RTFSs **240**, . . . , **246**. The RTEM **120** may have determined the interactive event IDs based on live event inputs, time-scheduled event inputs, and/or pre-recorded event inputs. The RTEM **120** may assign or associate the interactive event IDs to their appropriate fingerprints based on the synchronization of its operation to the operation of the RTFSs **240**, . . . , **246** via broadcast NTP. The RTEM **120** may also provide television network station identifiers and/or network timing information to the RTFSs **240**, . . . , **246**. The RTFSs **240**, . . . , **246** may communicate the fingerprints, interactive event IDs, the television network station identifiers, and/or the network timing information to their corresponding fingerprint vendors.

The client or viewer devices may take and send fingerprints to their corresponding fingerprint vendors, which in turn determine whether there is a match with the fingerprints received from the RTFSs. Upon detection or determination of a match, the fingerprint vendors may return to the viewer device various pieces of information, including but not limited to network timing information and any interactive event ID that is triggered as a result of the match.

The portion **100***b* in FIG. **2**B may illustrate the implementation of an abstraction layer that enables the ACR system **100** to assign the same interactive event identifiers to different sets of video and/or audio fingerprints that are generated from different fingerprint technologies. That is, by appropriately timing the assignment of interactive event identifiers to multiple sequences of fingerprints that are generated from the same video content but with different fingerprinting technologies, the ACR system **100** may be able to support fingerprinting technologies from multiple vendors. Such implementation may provide flexibility by enabling a vendor to update its fingerprinting technology without affecting other fingerprinting technologies. Moreover, the architecture of the ACR system **100** may provide scalability by enabling new or additional fingerprint technologies from other vendors or from the same vendors to be added and supported.

Referring to FIG. **2**C, there is shown a portion **100***c* of the ACR system **100** that may comprise the viewer devices **260**, . . . , **266** and the fingerprint vendors **250**, . . . , **256** shown in FIG. **2**B. Also shown are application data servers **270**, an analytics module **272**, a rules engine **274**, a cloud-based content delivery network (CDN) **275**, and a content management system (CMS) **276**. In addition, FIG. **2**C shows a user response module **280** and third-party partners/advertisers **282**.

The application data servers **270** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to receive from a viewer device information related to an interactive event ID, a network television station, fingerprinted broadcast time, CID and additional data, and/or a device type. The information may be provided by the viewer device in response to a match between a fingerprint taken by the device and a fingerprint taken by the corresponding RTFS. Once a match occurs and the viewer device obtains the appropriate information from its corresponding fingerprint vendor, the viewer device may communicate the information to the application data servers **270**, which in turn returns the appropriate content that corresponds to the interactive event ID and related data in a callback. Content may be pushed to a second screen or device paired with a connected TV that is logged in to an appropriate application or Web page.

The application data servers **270** may be operable to send information to the analytics module **272** as to what kind of interactions (e.g., clicks, selections, options, viewing behavior on a given broadcaster's network) are taking place in a viewer device. The application data servers **270** may be operable to handle the flow of user response data with third-party partners and/or advertisers **282**. The user response data may comprise, but need not be limited to, TV IDs, coupon IDs, and event IDs, for example. Communication of the user response data between the application data servers **270** and the third-party partners/advertisers **282** may be handled by the user response module **280**, for example. The application data servers **270** may be operable to call the CMS **276** for text, banners, graphics, overlays, and/or video, for example.

The application data servers **270** may also be operable to deliver event schedules to viewer devices, to deliver correct content uniform resource locator (URL) based on the type of viewer device, to integrate with a variety of back-end systems, to integrate with polling servers (not shown), to integrate with gaming services such as leader boards, and/or to integrate with customer databases such as those used in connection with store user preferences and social circle members, for example. With respect to integrating with back-end systems, the application data servers **270** may, for example, integrate with social networks for storage of tweets for later playback and/or to filter comments and push back to applications.

The rules engine **274** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to determine which platforms (e.g., viewer devices) are to be served and when are those platforms to be served by the application data servers **270**. The rules engine may be preconfigured and/or dynamically configured.

The CMS **276** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to store the content that is delivered to the viewer devices. For example, content that may be delivered may comprise text, banners, graphics, overlays, and video. Other examples of content may comprise polls and fun facts, clips to share, games and trivia, and advertising content. These examples are provided by way of illustration and not of limitation. Accordingly, other examples of contents that may be utilized for user interactive events with the viewer devices may also be stored in the CMS **276**.

The CMS **276** may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to enable communication between the application data servers **270** and the CDN

275. The CMS 276 is operable to post assets to the CDN 275. ACR-based devices are operable to download the assets (graphics, banners, overlays, video, etc) from the CDN 275.

The analytics module 272 may comprise suitable logic, circuitry, code, and/or interfaces that may be operable to receive user interaction information from the application data servers 270 or directly from the viewing devices. The analytics module 272 may comprise one or more back-end databases to store, mange, and/or process user information.

In operation, content may be provided by the application data servers 270 to one of the viewer devices 260, . . . , 266 in response to receiving an interactive event ID, a network television station, device type, and other data from that viewer device. Rules regarding which viewer device is to be served, and when the device may be served, may be determined by the rules engine 274. The content to be served by the application data servers 270 to the viewer device may be stored in the CMS 276.

The analytics module 272 may determine which viewers are interacting with content and what those viewers are watching based on information received from the application data servers 270 or directly from the viewing devices. Viewer responses that result from interactive events may be handled by the user response module 280, which in turn communicates with third-party partners/advertisers 282.

The third-party partners/advertisers 282 may comprise and/or be connected to advertisement servers and/or one or more fulfillment systems. The advertisement servers may be utilized to deliver advertisement overlays to ACR-based applications running on viewer devices. The advertisement servers may also be operable to support the tracking of user impressions and click-throughs and/or to perform other advertising-related functions.

The fulfillment systems may utilize one or more technologies to fulfill viewer requests that occur in connection with ACR-based applications and user interaction. Examples of such technologies may comprise, but need not be limited to, coupon delivery technologies, technologies for movie ticket purchases and delivery, and/or short message service/multimedia messaging service (SMS/MMS) gateways

FIGS. 3A-3C are block diagrams illustrating an exemplary outcome prediction utilizing automatic content recognition, in accordance with an embodiment of the invention. Referring to FIGS. 3A-3C, there is shown an ACR-enabled connected device 141 and a paired device 143. The ACR-enabled connected device 141 is paired with or associated with the paired device 143. The ACR-enabled connected device 141 and the paired device 143 are described, for example, with respect to FIG. 1A.

Referring to FIG. 3A, there is shown an overlay 303. The overlay 303 may comprise information on possible outcomes 304 of an identified event 301 that is to take place in a presented program 302. The overlay 303 may also be presented on the paired device 143. In an exemplary embodiment of the invention, the presented program 302 may be an American football sport. In this regard, the identified event 301 may be a play or down in the American football sport, for example. The possible outcomes 304 may comprise, for example, a pass, a run, a punt, a touchdown, a field goal attempt, a made field goal, a missed field goal, a turnover, etc.

In an exemplary operation, the ACR module 142 in the ACR-enabled connected device 141 may be operable to identify, utilizing an ACR system 100, the event 301 that is to take place in the presented program 302 associated with a network. The ACR-enabled connected device 141 may be paired with or associated with the paired device 143 utilizing the companion application 144 downloaded in and running on the paired device 143. The overlay 303 may be presented by the ACR module 142 in the ACR-enabled connected device 141, utilizing the ACR system 100, for a viewer 106 to interact within a specific time window synchronized with the identified event 301. In this regard, the overlay 303 may comprise information on possible outcomes 304 of the identified event 301 and the overlay 303 may also be presented on the paired device 143, for example. The ACR module 142 in the ACR-enabled connected device 141 may be operable to identify, utilizing the ACR system 100, a predicted outcome or outcomes selected by the viewer 106 among the possible outcomes 304. In this regard, the predicted outcome(s) may be selected by the viewer 106, within the specific time window, via interaction with the overlay 303 on the ACR-enabled connected device 141 or on the paired device 143. The ACR module 142 in the ACR-enabled connected device 141 may delineate, utilizing the ACR system 100, when the viewer 106 may participate in the selection and when the participation may be blocked within the synchronized specific time window.

Referring to FIG. 3B, there is shown an overlay 306. The overlay 306 may comprise a message indicating whether the predicted outcome selected by the viewer 106 is correct. The overlay 306 may also be presented on the paired device 143.

In an exemplary operation, the ACR module 142 in the ACR-enabled connected device 141 may be operable to track the event 301 and identify an actual outcome 305 that actually takes place, utilizing the ACR system 100. A message in the overlay 306 indicating whether the viewer 106 is correct or incorrect in the selection, based on the identified actual outcome or outcomes 305, may be presented by the ACR module 142 in the ACR-enabled connected device 141 utilizing the ACR system 100. In this regard, the message in the overlay 306 may also be presented on the paired device 143.

Referring to FIG. 3C, there is shown an overlay 307. The overlay 307 may comprise information on a reward or a prize 310. The reward may be points allotted and then a prize offered based on total points accumulated throughout the game. The overlay 307 may also be presented on the paired device 143.

In an exemplary operation, in instances when the viewer 106 is correct in the selection of the predicted outcome, the ACR module 142 in the ACR-enabled connected device 141 may be operable to present, utilizing the ACR system 100, the overlay 307 which comprises the information on the reward or the prize 310. In this regard, the information on the reward or the prize 310 in the overlay 307 may also be presented on the paired device 143.

FIGS. 4A-4C are block diagrams illustrating an exemplary outcome prediction competition utilizing automatic content recognition, in accordance with an embodiment of the invention. Referring to FIGS. 4A-4C, there is shown an ACR-enabled connected device 141, a paired device 143 and other devices 404. The other devices 404 may be associated with other viewers 107, for example. The ACR-enabled connected device 141 may be paired with or associated with the paired device 143. The ACR-enabled connected device 141 and the paired device 143 are described, for example, with respect to FIG. 1A.

Referring to FIG. 4A, there is shown an overlay 401. The overlay 401 may comprise information on possible outcomes 304 of an identified event 301 that is to take place in a presented program 302 as well as information on options 402 for a viewer 106 to compete with one or more other viewers 107. The overlay 401 may also be presented on the paired device 143 and on one or more of the other devices 404. In an exemplary embodiment of the invention, the presented pro-

gram **302** may be an American football sport. In this regard, the identified event **301** may be a play or down in the American football sport, for example. The possible outcomes **304** may comprise, for example, a pass, a run, a punt, a touchdown, a field goal attempt, a made field goal, a missed field goal, a turnover, etc. The options **402** may comprise a YES and a NO, for example.

In an exemplary operation, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, the event **301** that is to take place in the presented program **302** associated with a network. The ACR-enabled connected device **141** may pair with the paired device **143** utilizing the companion application **144** downloaded in and running on the paired device **143**. The overlay **401** may be presented by the ACR module **142** in the ACR-enabled connected device **141**, utilizing the ACR system **100**, for the viewer **106** to interact within a specific time window synchronized with the identified event **301**. In this regard, the overlay **401** may comprise information on possible outcomes **304** of the identified event **301** in the presented program **302** as well as information on the options **402** for the viewer **106** to compete with one or more other viewers **107**. The overlay **401** may also be presented on the paired device **143**. The overlay **401** may also be presented on one or more of the other devices **404** associated with one or more of the other viewers **107** who may participate in the selection. In this regard, the overlay **401** may be presented, via the ACR system **100**, on each of the one or more of the other devices **404** within the specific time window, which may be synchronized with the identified event **301** in the program **302** that is presented on each of the one or more of the other devices **404**. This synchronization may enable the locking of a participation period to account for differences in delays for various networks among the viewer **106** and the one or more of the other viewer **107**.

The ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, a predicted outcome or outcomes selected by the viewer **106** and an option to compete selected by the viewer **106**. In this regard, the predicted outcome(s) and the option to compete are selected by the viewer **106**, within the specific time window, via interaction with the overlay **401** on the ACR-enabled connected device **141** or on the paired device **143**. The predicted outcomes and the options to compete selected by one or more of the other viewers **107** may also be identified, via the ACR system **100**, within the synchronized specific time window. In this regard, the competition operation utilizing the ACR system **100** may be support by third-parties, including licensed betting operations, for example.

Referring to FIG. **4**B, there is shown an overlay **407** and an overlay **408**. The overlay **407** may comprise a message indicating whether the predicted outcome(s) selected by the viewer **106** is correct and other information related to the competition. The overlay **407** may also be presented on the paired device **143**. The overlay **408** may comprise a message indicating whether the predicted outcome selected by one of the other viewers **107** is correct and other information related to the competition.

In an exemplary operation, the ACR module **142** in the ACR-enabled connected device **141** may be operable to track the event **301** and identify an actual outcome **305** that actually takes place, utilizing the ACR system **100**. A message in the overlay **407** indicating whether the viewer **106** is correct or incorrect in the selection, based on the identified actual outcome or outcomes **305**, may be presented by the ACR module **142** in the ACR-enabled connected device **141** utilizing the ACR system **100**. In this regard, the message in the overlay **307** may also be presented on the paired device **143**. The overlay **408** may be presented on one or more of the other devices **404** associated with one or more of the other viewers **107** who may participate in the competition. The overlay **408** may comprise a message indicating whether the predicted outcome selected by one of the one or more of the other viewers **107** is correct and other information related to the competition.

Referring to FIG. **4**C, there is shown an overlay **409** and an overlay **410**. The overlay **409** may comprise information on a reward or a prize **411** for the viewer **106**. The overlay **409** may also be presented on the paired device **143**. The overlay **410** may comprise information on a reward or a prize for one of the other viewers **107** who participate in the competition.

In an exemplary operation, the ACR module **142** in the ACR-enabled connected device **141** may be operable to present, utilizing the ACR system **100**, the overlay **409** which comprises the information on the reward or the prize **411** based on a result of the selections of the predicted outcomes from the viewer **106** and from one or more of the other viewers **107** who may participate in the competition. The information on the reward or the prize **411** in the overlay **409** may also be presented on the paired device **143**. The overlay **410** may be presented on one or more of the other devices **404** associated with one or more of the other viewers **107** who may participate in the competition. The overlay **410** may comprise information on the reward or the prize for each of the one or more of the other viewers **107** who may participate in the competition. In this regard, for example, the viewer **106** may get points or the like based on a successful selection of a play **301** in the American football sport **302**. The total number of points that the viewer **106** may get in the competition may be based on the number of successful predictions throughout the American football sport **302**. The reward or the prize **411** that the viewer **106** may receive may be based on the total number of the points that the viewer **106** gets and the total number of points that each of the other participants gets in the competition.

FIG. **5** is a flow chart illustrating exemplary steps for outcome prediction utilizing automatic content recognition, in accordance with an embodiment of the invention. Referring to FIG. **5**, the exemplary steps start at step **501**. In step **502**, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing an ACR system such as the ACR system **100**, an event **301** that is to take place in a presented program **302** associated with a network. In this regard, the ACR-enabled connected device **141** may be paired with or associated with a paired device such as the paired device **143** utilizing the companion application **144** downloaded in and running on the paired device **143**. In step **503**, an overlay **303** may be presented by the ACR module **142** in the ACR-enabled connected device **141**, utilizing the ACR system **100**, for a viewer **106** to interact within a specific time window synchronized with the identified event **301**. In this regard, the overlay **303** may comprise information on possible outcomes **304** of the identified event **301** and the overlay **303** may also be presented on the paired device **143**, for example. In step **504**, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, a predicted outcome or outcomes selected by the viewer **106** among the possible outcomes **304**. In this regard, the predicted outcome(s) may be selected by the viewer **106**, within the specific time window, via interaction with the overlay **303** on the ACR-enabled connected device **141** or on the paired device **143**.

In step **505**, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing

the ACR system **100**, an actual outcome or outcomes **305** that actually takes place. In step **506**, a message in an overlay **306** indicating whether the viewer **106** is correct or incorrect in the selection, based on the identified actual outcome or outcomes **305**, may be presented by the ACR module **142** in the ACR-enabled connected device **141** utilizing the ACR system **100**. In this regard, the message in the overlay **306** may also be presented on the paired device **143**. In step **507**, in instances when the viewer **106** is correct in the selection of the predicted outcome(s), the ACR module **142** in the ACR-enabled connected device **141** may be operable to present, utilizing the ACR system **100**, information on a reward or a prize **310** in an overlay **307**. In this regard, the information on the reward or the prize **310** in the overlay **307** may also be presented on the paired device **143**. The exemplary steps may proceed to the end step **508**.

FIG. **6** is a flow chart illustrating exemplary steps for outcome prediction competition utilizing automatic content recognition, in accordance with an embodiment of the invention. Referring to FIG. **6**, the exemplary steps start at step **601**. In step **602**, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing an ACR system such as the ACR system **100**, an event **301** that is to take place in a presented program **302** associated with a network. In this regard, the ACR-enabled connected device **141** may be paired with or associated with a paired device such as the paired device **143** utilizing the companion application **144** downloaded in and running on the paired device **143**. In step **603**, an overlay **401** may be presented by the ACR module **142** in the ACR-enabled connected device **141**, utilizing the ACR system **100**, for a viewer such as the viewer **106** to interact within a specific time window synchronized with the identified event **301**. In this regard, the overlay **401** may comprise information on possible outcomes **304** of the identified event **301** in the presented program **302** as well as information on options **402** for the viewer **106** to compete with one or more other viewers **107**. The overlay **401** may also be presented on the paired device **143**, for example. In this regard, the overlay **401** may also be presented on one or more of the other devices **404** associated with the one or more other viewers **107** who may participate in the selection. In this regard, the overlay **401** may be presented, via the ACR system **100**, to each of the one or more other viewers **107** within the specific time window which is synchronized with the identified event **301** in the program **302** that is presented to each of the one or more other viewers **107**.

In step **604**, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, a predicted outcome or outcomes selected by the viewer **106** and an option to compete selected by the viewer **106**. The predicted outcome(s) and the option to compete are selected by the viewer **106**, within the specific time window, via interaction with the overlay **401** on the ACR-enabled connected device **141** or on the paired device **143**. In this regard, the predicted outcomes and the options to compete selected by the one or more other viewers **107** may also be identified, via the ACR system **100**, within the synchronized specific time window. In step **605**, the ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, an actual outcome or outcomes **305** that actually take(s) place. In step **606**, the ACR module **142** in the ACR-enabled connected device **141** may be operable to present, utilizing the ACR system **100**, information on a reward or a prize **411** in an overlay **409** based on a result of the selections of the predicted outcomes from the viewer **106** and from the one or more other viewers **107**. The information on the reward or the prize **411** in the overlay **409** may also be presented on the paired device **143**, for example. In this regard, information on a reward or a prize for each of the one or more other viewers **107** who participate in the competition may also be presented to each of the one or more other viewers **107**. The exemplary steps may proceed to the end step **607**.

In various embodiments of the invention, an ACR module **142**, in an ACR-enabled connected device **141** coupled to an ACR system **100**, may be operable to identify, utilizing the ACR system **100**, an event **301** that is to take place in a presented program **302** associated with a network. The ACR-enabled connected device **141** may be paired with or associated with a paired device **143** utilizing a companion application **1144** downloaded in and running on the paired device **143**. An overlay **303** may be presented by the ACR module **142** in the ACR-enabled connected device **141**, utilizing the ACR system **100**, for a viewer **106** to interact within a specific time window synchronized with the identified event **301**. In this regard, the overlay **303** may comprise information on possible outcomes **304** of the identified event **301** and the overlay **303** may also be presented on the paired device **143**, for example.

The ACR module **142** in the ACR-enabled connected device **141** may be operable to identify, utilizing the ACR system **100**, a predicted outcome or outcomes selected by the viewer **106**. In this regard, the predicted outcome(s) may be selected by the viewer **106**, within the specific time window, via interaction with the overlay **303** on the ACR-enabled connected device **141** or on the paired device **143**. An actual outcome **305** that actually takes place may then be identified by the ACR module **142** in the ACR-enabled connected device **141** utilizing the ACR system **100**. The ACR module **142** in the ACR-enabled connected device **141** may be operable to present, utilizing the ACR system **100**, a message in an overlay **306** indicating whether the viewer **106** is correct or incorrect in the selection based on the identified actual outcome **305**, and the message may also be presented on the paired device **143**. In instances when the viewer **106** is correct in the selection, information on a reward or a prize **310** may be presented by the ACR module **142** in the ACR-enabled connected device **141** utilizing the ACR system **100**, and the information on the reward or the prize **310** may also be presented on the paired device **143**.

In an exemplary embodiment of the invention, the overlay **401** may also comprise information on options **402** for the viewer **106** to compete with one or more other viewers **107** who may also participate in the selection of the predicted outcome. In this regard, the overlay **401** may be presented, via the ACR system **100**, to each of the one or more other viewers **107**, within the specific time window, which may be synchronized with the identified event **301** in the program **302** that is presented to each of the one or more other viewers **107**. The ACR module **142** in the ACR-enabled connected device **141** may then be operable to present, utilizing the ACR system **100**, information on a reward or a prize **411** based on a result of the selections of the predicted outcomes from the viewer **106** and from the one or more other viewers **107**. The information on the reward or the prize **411** may also be presented on the paired device **143**.

In an exemplary embodiment of the invention, the presented program **302** may comprise a sports program or game such as American football. In this regard, the identified event **301** may comprise a play in the sports program or game such as, for example, a play in the American football sports program. The possible outcomes **304** may comprise, for example, a pass, a run, a punt, a touchdown, a field goal attempt, a made field goal, a missed field goal, a turnover, etc.

associated with the play in the American football sports program. Other sports, games, and/or promotions may be illustrated without departing from the spirit and scope of various embodiments of the invention.

Other embodiments of the invention may provide a non-transitory computer readable medium and/or storage medium, and/or a non-transitory machine readable medium and/or storage medium, having stored thereon, a machine code and/or a computer program having at least one code section executable by a machine and/or a computer, thereby causing the machine and/or computer to perform the steps as described herein for outcome prediction utilizing automatic content recognition.

Accordingly, the present invention may be realized in hardware, software, or a combination of hardware and software. The present invention may be realized in a centralized fashion in at least one computer system or in a distributed fashion where different elements are spread across several interconnected computer systems. Any kind of computer system or other apparatus adapted for carrying out the methods described herein is suited. A typical combination of hardware and software may be a general-purpose computer system with a computer program that, when being loaded and executed, controls the computer system such that it carries out the methods described herein.

The present invention may also be embedded in a computer program product, which comprises all the features enabling the implementation of the methods described herein, and which when loaded in a computer system is able to carry out these methods. Computer program in the present context means any expression, in any language, code or notation, of a set of instructions intended to cause a system having an information processing capability to perform a particular function either directly or after either or both of the following: a) conversion to another language, code or notation; b) reproduction in a different material form.

While the present invention has been described with reference to certain embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted without departing from the scope of the present invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the present invention without departing from its scope. Therefore, it is intended that the present invention not be limited to the particular embodiment disclosed, but that the present invention will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A method, comprising:

in an automatic content recognition (ACR)-enabled connected TV device which is paired with or associated with a paired device utilizing a companion application running on said paired device, wherein:

said ACR-enabled connected TV device comprises an ACR module that communicates with an ACR system that is external to said automatic content recognition (ACR)-enabled connected TV device;

said ACR system comprises an abstraction layer that supports different video and audio fingerprint technologies from multiple vendors, wherein said abstraction layer enables said ACR system to assign same interactive event identifiers to different sets of video and audio fingerprints that are generated by said different video and audio fingerprint technologies from said multiple vendors based on timing of said assignment of said interactive event identifiers, and said interactive event identifiers are utilized to trigger one or more events;

said ACR module providing fingerprints to said ACR system for matching; and

said ACR module receiving information and/or content from the said ACR system based on said matching; and

said ACR-enabled connected device:

identifying by said ACR module based on at least one of said interactive event identifiers, an event that is to take place in a presented program associated with a network;

presenting by said ACR module, an overlay for a viewer to interact within a specific time window synchronized with said identified event, wherein said overlay comprises information on possible outcomes of said identified event, and said overlay is also presented on said paired device; and

identifying by said ACR module, a predicted outcome selected by said viewer, wherein said predicted outcome is selected by said viewer, via interaction with said overlay on said ACR-enabled connected device or on said paired device.

2. The method according to claim **1**, comprising identifying by said ACR module, an actual outcome that actually takes place.

3. The method according to claim **2**, comprising presenting by said ACR module, a message indicating whether said viewer is correct or incorrect in said selection based on said identified actual outcome, wherein said message is also presented on said paired device.

4. The method according to claim **3**, comprising presenting by said ACR module, information on a reward or a prize when said viewer is correct in said selection, wherein said information on said reward or said prize is also presented on said paired device.

5. The method according to claim **1**, wherein said overlay comprises information on options for said viewer to compete with one or more other viewers who also participate in said selection of said predicted outcome.

6. The method according to claim **5**, wherein said overlay is presented by said ACR module, to each of said one or more other viewers, within said specific time window which is synchronized with said identified event in said program that is presented to each of said one or more other viewers.

7. The method according to claim **5**, comprising presenting by said ACR module, information on a reward or a prize based on a result of said selections of said predicted outcomes from said viewer and said one or more other viewers, wherein said information on said reward or said prize is also presented on said paired device.

8. The method according to claim **1**, wherein said presented program comprise a sports program.

9. The method according to claim **8**, wherein said identified event comprises a play in said sports program.

10. The method according to claim **1**, wherein said predicted outcome is selected by said viewer, within said specific time window, via said interaction with said overlay on said ACR-enabled connected device or on said paired device.

11. A system, comprising:

an automatic content recognition (ACR)-enabled connected TV device coupled to an ACR system, said ACR-enabled connected device being paired with or associated with a paired device utilizing a companion application running on said paired device, wherein:

said ACR-enabled connected TV device comprises an ACR module that communicates with an ACR system that is external to said automatic content recognition (ACR)-enabled connected TV device;

said ACR system comprises an abstraction layer that supports different video and audio fingerprint technologies from multiple vendors, wherein said abstraction layer enables said ACR system to assign same interactive event identifiers to different sets of video and audio fingerprints that are generated by said different video and audio fingerprint technologies from said multiple vendors based on timing of said assignment of said interactive event identifiers, and said interactive event identifiers are utilized to trigger one or more events;

said ACR module providing fingerprints to said ACR system for matching;

said ACR module receiving information and/or content from the said ACR system based on said matching; and

said ACR-enabled connected device being operable to:

identify by said ACR module based on at least one of said interactive event identifiers, an event that is to take place in a presented program associated with a network;

present by said ACR module, an overlay for a viewer to interact within a specific time window synchronized with said identified event, wherein said overlay comprises information on possible outcomes of said identified event, and said overlay is also presented on said paired device; and

identify by said ACR module, a predicted outcome selected by said viewer, wherein said predicted outcome is selected by said viewer, via interaction with said overlay on said ACR-enabled connected device or on said paired device.

12. The system according to claim **11**, wherein said ACR-enabled connected device is operable to identify by said ACR module, an actual outcome that actually takes place.

13. The system according to claim **12**, wherein said ACR-enabled connected device is operable to present by said ACR module, a message indicating whether said viewer is correct or incorrect in said selection based on said identified actual outcome, and said message is also presented on said paired device.

14. The system according to claim **13**, wherein said ACR-enabled connected device is operable to present by said ACR module, information on a reward or a prize when said viewer is correct in said selection, and said information on said reward or said prize is also presented on said paired device.

15. The system according to claim **11**, wherein said overlay comprises information on options for said viewer to compete with one or more other viewers who also participate in said selection of said predicted outcome.

16. The system according to claim **15**, wherein said overlay is presented by said ACR module, to each of said one or more other viewers, within said specific time window which is synchronized with said identified event in said program that is presented to each of said one or more other viewers.

17. The system according to claim **15**, wherein said ACR-enabled connected device is operable to present by said ACR module, information on a reward or a prize based on a result of said selections of said predicted outcomes from said viewer and said one or more other viewers, and said information on said reward or said prize is also presented on said paired device.

18. The system according to claim **11**, wherein said presented program comprise a sports program.

19. The system according to claim **18**, wherein said identified event comprises a play in said sports program.

20. The system according to claim **11**, wherein said predicted outcome is selected by said viewer, within said specific time window, via said interaction with said overlay on said ACR-enabled connected device or on said paired device.

21. A system, comprising:

an automatic content recognition (ACR) system comprising:

a fingerprint matching system;

a plurality real-time fingerprint servers;

wherein:

said finger print matching system is communicatively coupled to said plurality of real-time fingerprint servers; and

said ACR system comprises an abstraction layer that interfaces with said plurality real-time fingerprint servers to support different video and audio fingerprint technologies from multiple vendors, wherein said abstraction layer enables said ACR system to assign same interactive event identifiers to different sets of video and audio fingerprints that are generated by said different video and audio fingerprint technologies from said multiple vendors based on timing of said assignment of said interactive event identifiers, and said interactive event identifiers are utilized to trigger one or more events; and

an ACR-enabled connected TV device comprising an ACR module that communicates with said ACR system, wherein:

said ACR system is external to said ACR-enabled connected TV device; and

said ACR-enabled connected TV device is paired with or associated with a paired device utilizing a companion application running on said paired device;

wherein:

said ACR module provides fingerprints to said finger print matching system for matching; and

said ACR module receives information and/or content from said ACR system based on said matching; and

said ACR-enabled connected device is operable to:

identify, by said ACR module based on at least one of said interactive event identifiers, an event that is to take place in a presented program associated with a network;

present, by said ACR module, an overlay for a viewer to interact within a specific time window synchronized with said identified event, wherein said overlay comprises information on possible outcomes of said identified event, and said overlay is also presented on said paired device; and

identify, by said ACR module, a predicted outcome selected by said viewer, wherein said predicted outcome is selected by said viewer, via interaction with said overlay on said ACR-enabled connected device or on said paired device.

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